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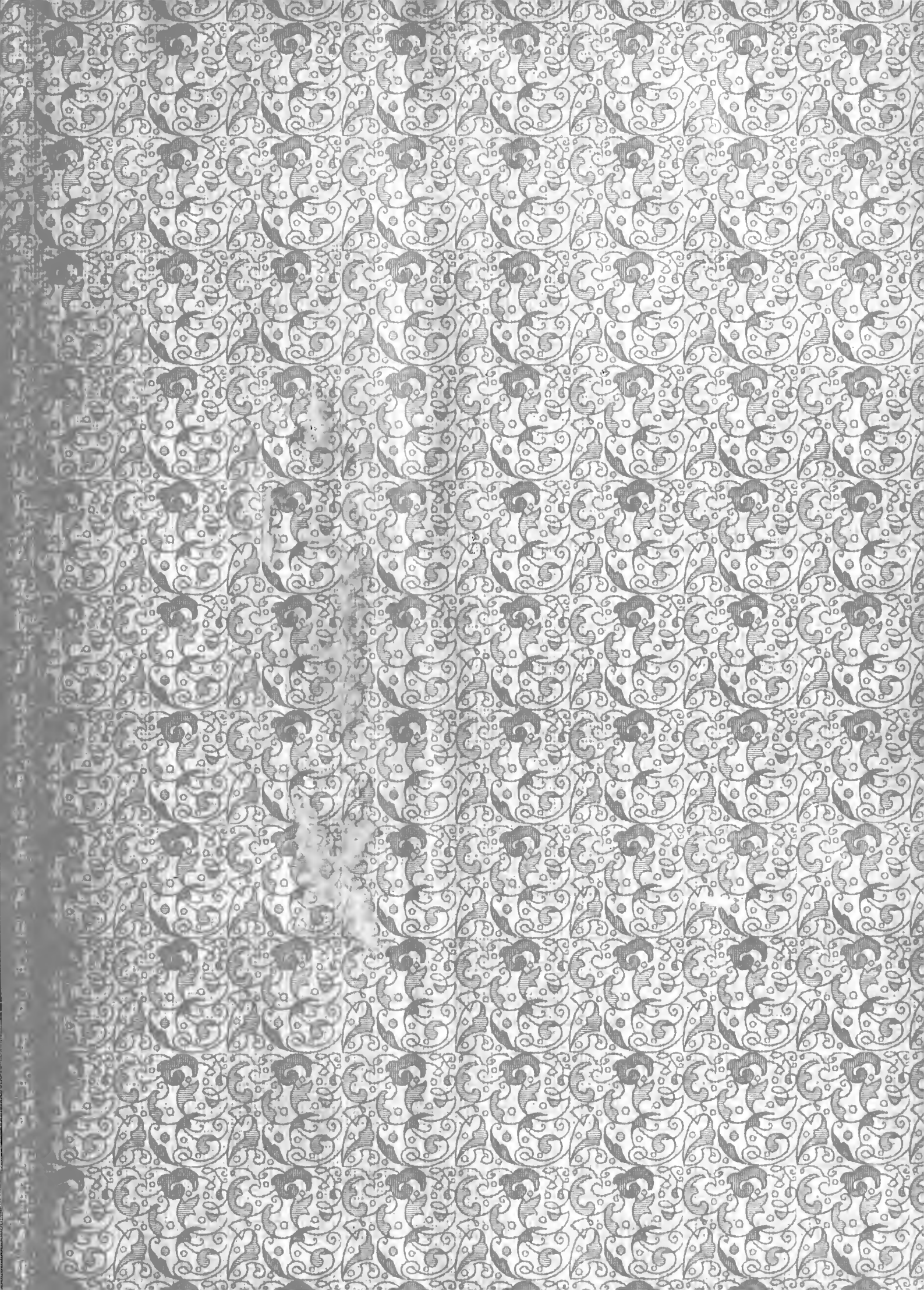
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SAN FRANCISCO, JULY 1, 1916

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BY S. T. HARDING.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING.

BY JOSEPH JACOBS.

OIL WELL MOTOR EQUIPMENTS.

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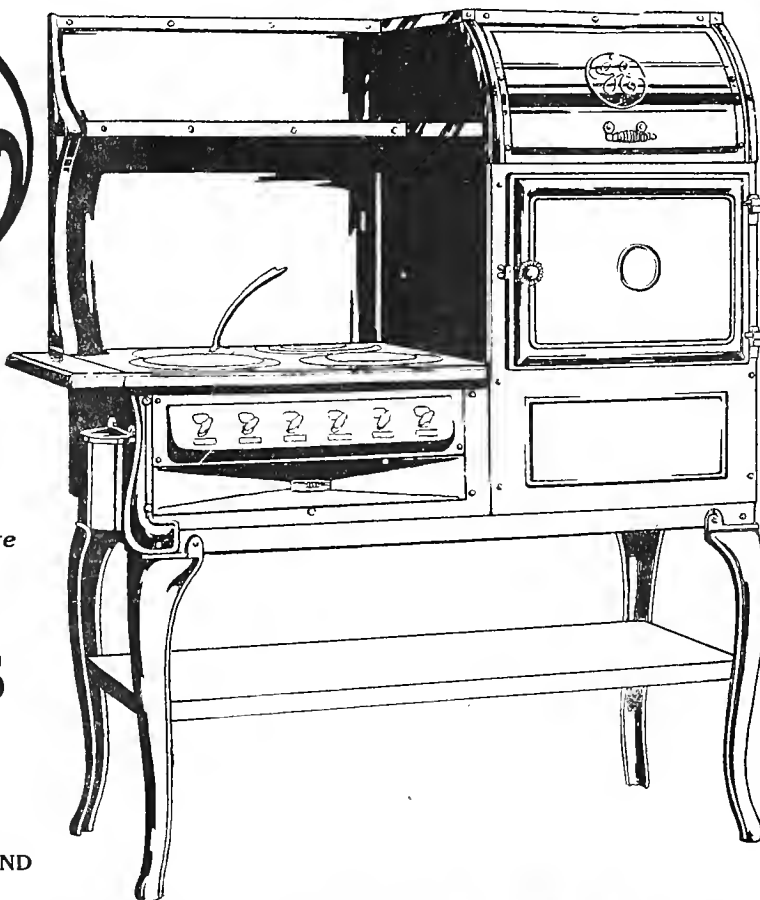
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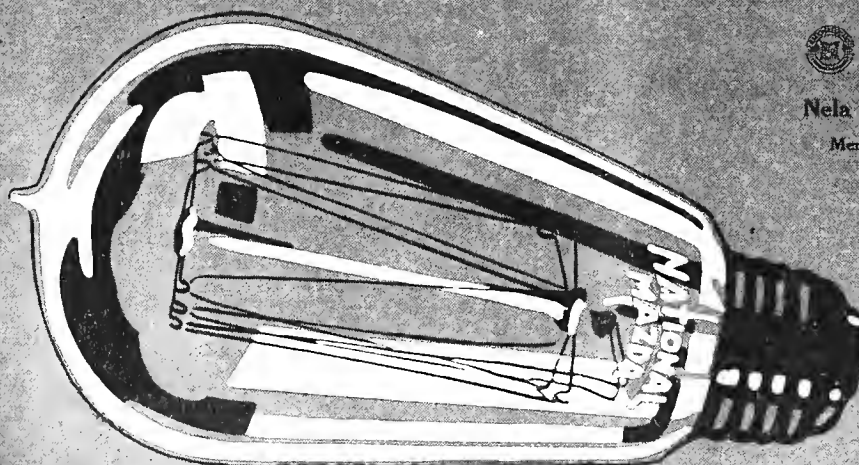
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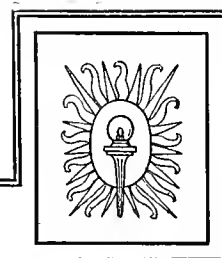
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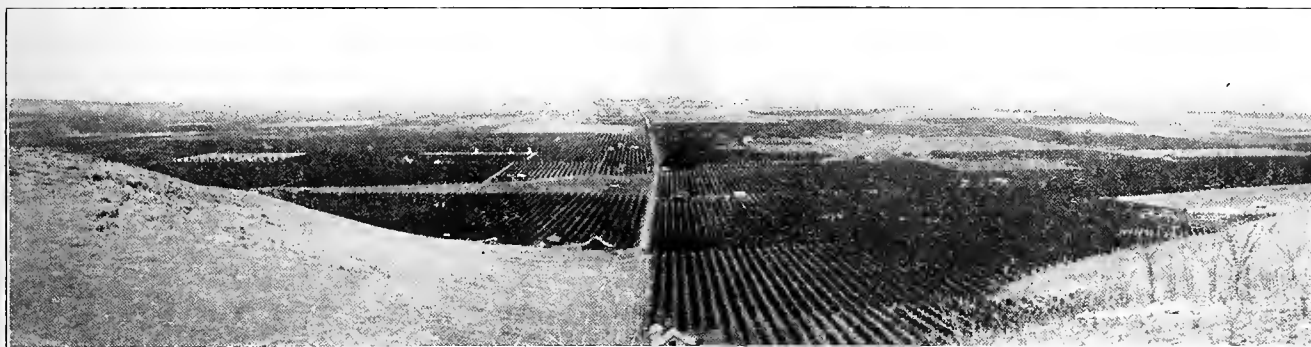
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What Irrigation Has Accomplished in the San Joaquin Valley.

AGRICULTURAL USES OF POWER

MT. WHITNEY POWER AND ELECTRIC COMPANY'S SYSTEM

BY S. T. HARDING.

In the recent case before the California Railroad Commission involving this company (application No. 1673, Decision No. 3242, decided April 6, 1916) a large amount of data regarding the agricultural use of power was submitted by the Mt. Whitney Power & Electric Company. The following material has been compiled from these exhibits.

The proportion of load of this company used for agricultural purposes is unusually high, as is shown in Table 1.

Table 1—Distribution of Business of Mt. Whitney Power & Electric Company, August 1, 1915.

Character of Use.	No. of Motors.	Total H.P. of Motors.	Per Ct. of Total No.	Per Ct. of Total H.P.
Agricultural	1,666	14,316	66.5	81.8
Domestic	495	758	19.8	4.3
Industrial	298	1,654	11.9	9.5
Railroad	2	375	...	2.1
Miscellaneous	44	397	1.8	2.3
Total	2,505	17,500	100.0	100.0

In view of the fact that the domestic use is largely on farms and that the industrial use is mainly by packing and canning factories, over 90 per cent of the load is directly related to agricultural development. A total of 67,481 acres was irrigated by pumps, whose power was supplied by this system. The distribution of this area among the various crops is shown in Table 2.

Table 2—Acreage of Different Crops Irrigated by Power Supplied by Mt. Whitney Power & Electric Company.

Crops.	Acreage.	Per Cent of Total.
Citrus bearing	13,498	
Citrus non bearing	14,272	27.770
Olives bearing	392	
Olives non-bearing	2,641	3.033
Alfalfa	28,890	42.8
Miscellaneous orchards	1,156	1.7
Peaches	1,155	1.7
Vineyards	1,018	1.5
Miscellaneous field crops	4,458	6.6
Total	67,481	100.0

In addition, data were supplied on the installations which were used for either citrus or for alfalfa alone. These plants were all supplied under a flat rate of \$50 per horsepower per year. These figures are shown in Table 3. These apply to farms entirely in one crop and have a larger average size than the average for all farms supplied under this system.

Table 3—Average Conditions Under Plants Supplying Only One Kind of Crop.

	Bearing Citrus Orchards.	Non-bearing Citrus Orchards.	Alfalfa.
Acres included	8,388	7,009	17,775
Total horsepower installed	2,150	1,322	2,912
Total tested horsepower	1,816	1,121	2,826
Total annual power bill	\$90,798	\$56,037	\$141,306
Number acres irrigated per horsepower installed	3.90	5.30	6.1
Cost of power per acre per year	\$10.84	\$7.99	\$7.95
Average size of farm—acres	31.5	36.2	68.1
Average horsepower per farm	8.1	6.8	11.1
Average power bill per average ranch per year	\$341.40	\$288.85	\$538.75

Investigations made by the power company in November, 1914, showed 54 per cent of the load to be supplied under the flat rate of \$50 per horsepower per year, 18.1 per cent on the meter rate with a minimum of \$24 per horsepower per year and 14.5 per cent on meter rate with a minimum monthly charge of \$1 per horsepower installed capacity. The remainder of the load was supplied under various other forms of rates.

The large portion of the load supplied on the flat rate has given this company a high load factor. The company has found by interviews with farmers that most of the plants on this rate are run nearly continuously for a seven-month period. Each farmer installs as small a plant as practicable under continuous operation, in order to reduce the power bill, which depends on the maximum rate of use, instead of installing a

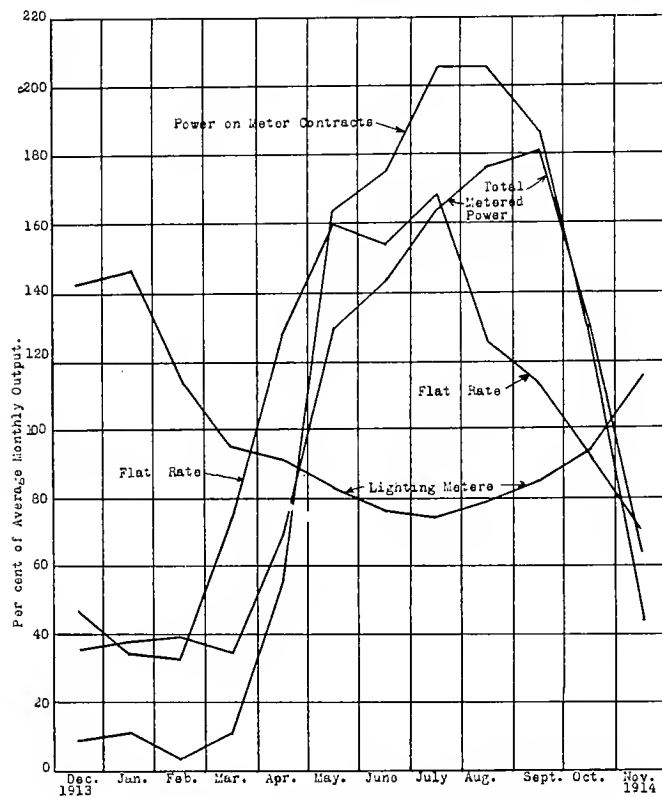


Fig. 1. Load Curves for Different Loads and Rates by Months Expressed as a Percentage of the Average Load.

larger plant and operating intermittently.. The motors for pumping give a nearly constant load. A large number of tests has shown the ratio of the average demand to the rated capacity of the motors to be 94.3 per cent. The average annual input per horsepower installed is 3595 kilowatt hours per year delivered at the plant. At the standard rate formerly in use of \$50 per horsepower per year, the farmers paid an average of 1.391 cents per kilowatt hour.

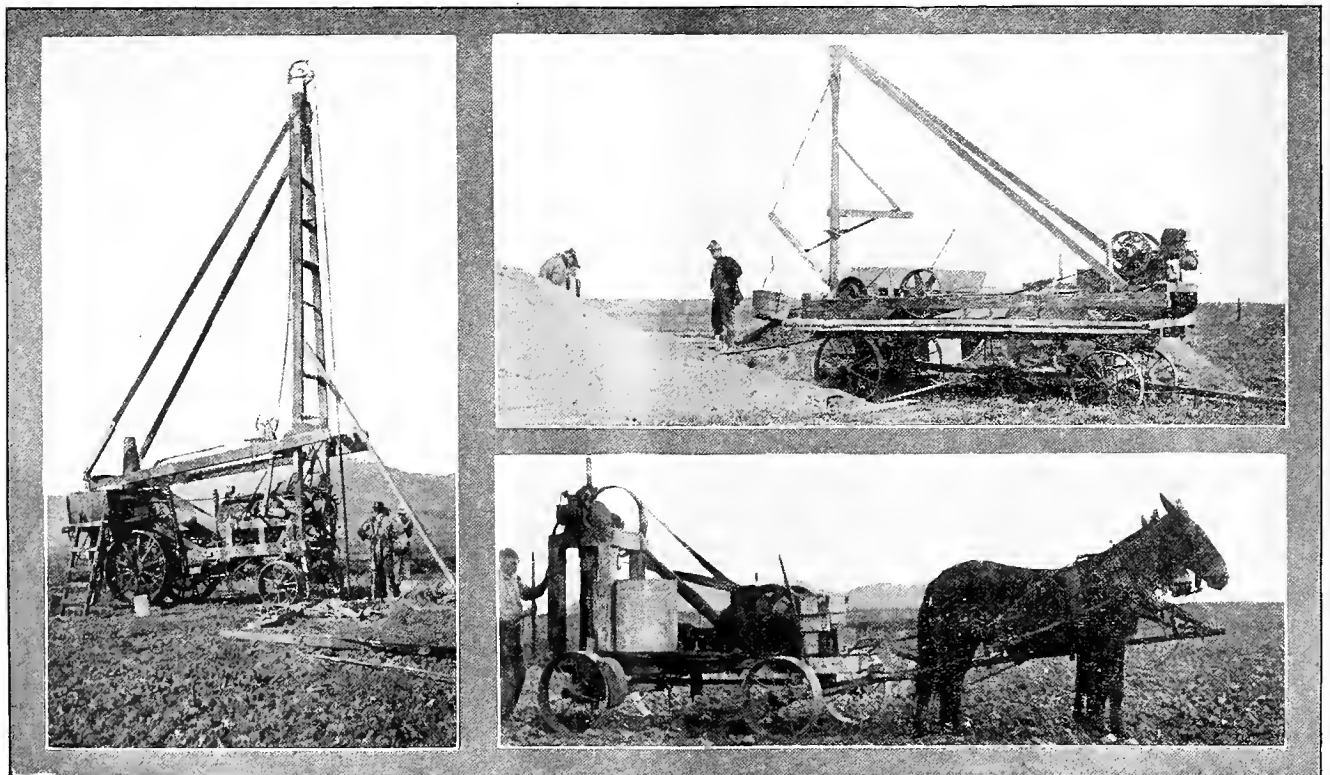
The monthly and annual load factors for 1912 to 1914 are shown in Table 4. April to October are the months of maximum irrigation use. The load factor for each month is the ratio of the maximum use during the month to the mean during the month; that for the year is the ratio of the maximum use during the year to the mean for the year.

Table 4—Monthly and Annual Load Factor, Mt. Whitney Power & Electric Company.

Month.	—Year—		
	1912.	1913.	1914.
January	58.3	60.3	61.1
February	48.3	65.2	69.1
March	72.0	74.3	52.7
April	65.9	67.9	70.1
May	63.1	79.3	81.3
June	72.3	74.8	81.7
July	79.0	79.0	90.6
August	79.0	81.8	87.3
September	81.2	84.8	81.1
October	67.9	69.0	70.8
November	68.1	61.6	66.4
December	69.4	63.9	67.8
Year	49.3	49.2	56.4

The load curves for the different forms of rates are shown in Fig. 1. The curve for the flat rate per horsepower year was obtained by deducting the total metered power and lights from 80 per cent of the substation monthly outputs, the remaining 20 per cent being the estimated line losses. The load curves for meter contracts are for all plants in operation for the full year ending May 30, 1914. The load in terms of the per cent of the total monthly output is plotted for each month. The more uniform load curve of the flat rate is quite noticeable.

The seasonal use of power for agricultural purposes as shown under circuits supplying citrus orchards and those supplying alfalfa is of much interest. These were segregated for the motors operating on the flat rate on the lines served by two 6600 volt banks in the Lindsay substation. The metered use was deducted. A 20 per cent estimated line loss was also deducted. The lighting load was insignificant. Over 90 per cent of the irrigation on these circuits



Portable Well Drilling Rigs of Various Types.

was estimated to be for orange orchards. The results are given in Table 5.

Table 5—Use of Power by Motors Operated on Flat Rate on Citrus Orchards.

Month.	Kilowatt Hrs. Per Tested Horsepower.				Hrs. Time Op'n, O'pd		
	1912.	1913.	1914.	1915.	Av.	Av.	Av.
January	74.4	111.0	30.7	35.0	62.8	85	11
February	100.4	107.6	46.3	83.2	84.4	113	17
March	117.6	135.7	168.7	147.4	142.3	191	26
April	96.6	270.8	357.4	370.9	273.9	367	51
May	304.3	370.3	340.5	228.3	310.8	417	56
June	390.5	352.9	343.3	394.4	370.3	496	65
July	406.5	399.1	344.1		383.2	514	73
August	408.7	388.8	342.6		380.0	509	72
September	339.2	159.8	284.5		261.2	350	46
October	241.1	125.3	186.7		184.4	247	33
November	97.0	20.4	47.2		54.9	74	10
December	141.0	49.7	40.8	6 mos.	77.2	104	14
Total	2,717.3	2,491.4	2,532.8	1,259.2	2,585.4	3,467	40

Similar data were segregated for the power supplied from the Tulare station, which is used wholly for the irrigation of alfalfa. These show a much greater annual variation than the results for the use in the citrus districts. This is accounted for in part at least by the varying prices received during these years for alfalfa. Many farmers raising alfalfa for sale put on all the water which they could pump in 1912 and 1913. In 1914 and 1915, when the price of alfalfa fell, only sufficient water was used to keep the stand alive. The same general basis of deducting metered use and line loss was used for this circuit as for those from the Lindsay substation. The results are shown in Table 6.

The advantage to the company of the flat rate for agricultural power in the security of their returns from use is evident from this table. On a meter rate the

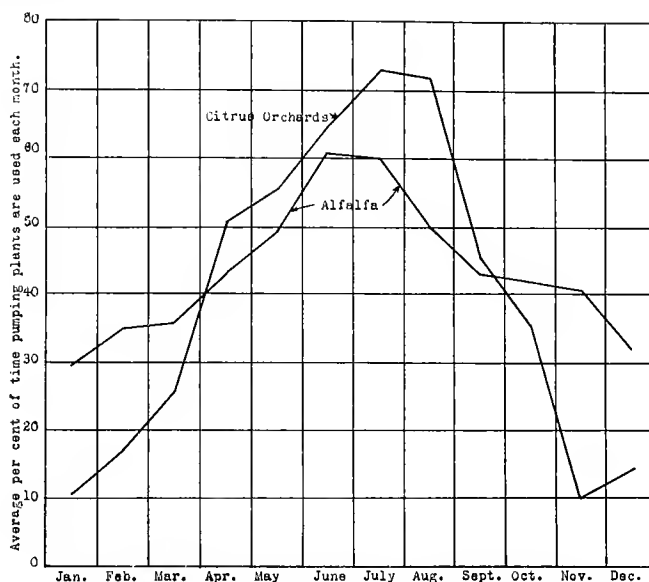
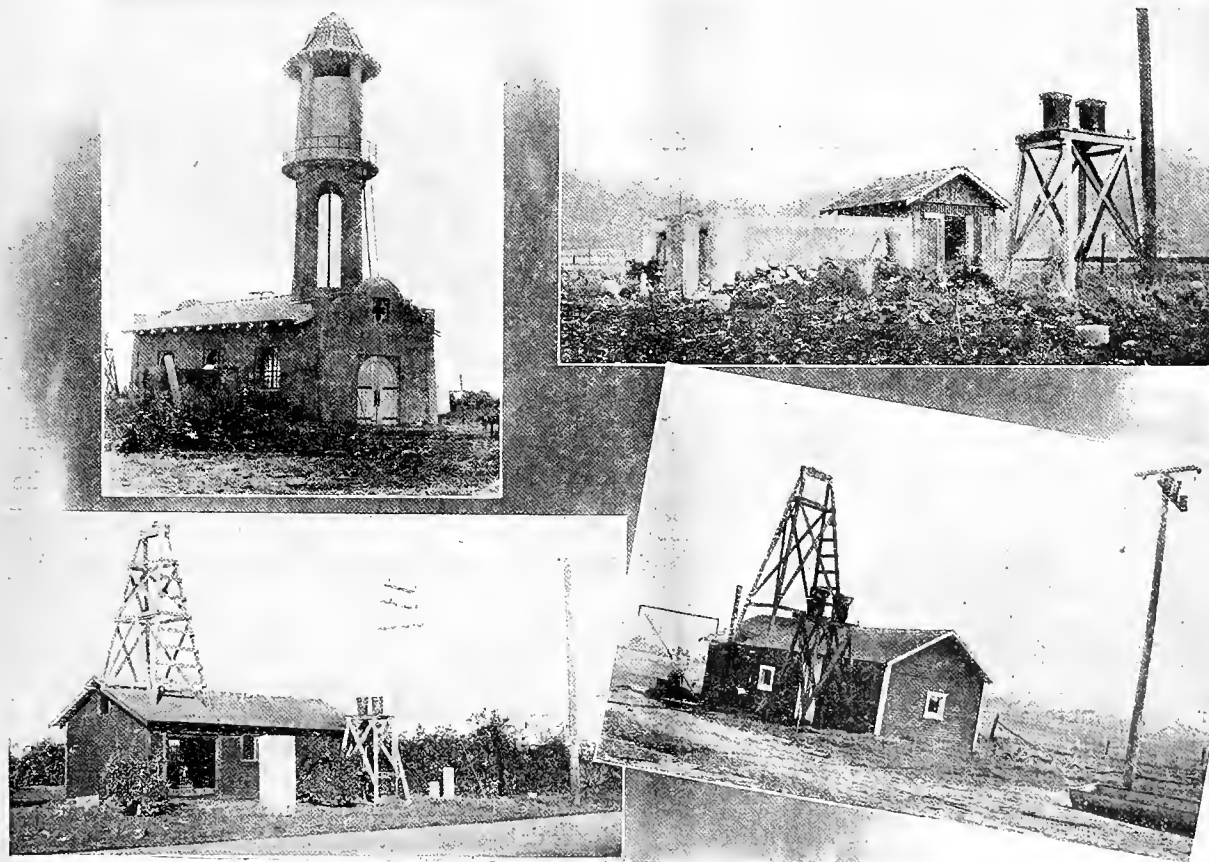


Fig. 2. Average Per Cent of Time Pumping Plants Are Used Each Month for Citrus Orchards and for Alfalfa.

Table 6—Use of Power by Motors on Flat Rate on Alfalfa.

Month.	Kilowatt Hrs. Per Tested Horsepower.				Hrs. Time Op'n, O'pd		
	1912.	1913.	1914.	1915.	Av.	Av.	Av.
January	175.1	270.7	134.9	55.8	159.1	213	29
February	247.2	282.5	139.9	21.7	172.8	232	35
March	251.6	313.0	208.3	22.1	198.8	266	36
April	235.6	317.2	307.1	64.6	231.1	310	43
May	261.3	351.2	321.6	146.0	270.0	362	49
June	333.2	323.0	314.5	344.0	328.7	441	61
July	347.6	367.0	287.9		334.2	448	60
August	333.8	397.1	108.7		279.9	375	50
September	244.3	359.6	83.8		229.2	307	43
October	258.9	351.6	97.3		235.9	316	42
November	306.0	262.5	88.1		218.9	293	41
December	240.5	230.6	64.5		178.5	239	32
Total	3,235.1	3,826.0	2,156.6		2,837.1	3,802	44



Typical Pumping Plants.

earnings from the irrigation of alfalfa would have fluctuated materially.

On this system there is an average of two consumers per mile of distributing line in the country. The cost to the company for distributing lines has been \$300 per consumer. It has been their practice not to extend lines for more than one mile to secure the installation of a $7\frac{1}{2}$ h.p. motor. By the enforcement of this rule, they have secured a service density of 13 h.p. per mile of primary distributing line.

The former standard flat rate contract required the consumer to supply all the plant, including the transformers. Five-year contracts, renewed or dropped on 30 days' notice at the end of each year, were used. This longer contract period was required to cover the cost of long connection lines. As their territory is now more fully covered with transmission lines, the expense of connections is usually less and a three-year period was fixed in the decision of the commission. The flat rate was formerly based on annual tests made between May and August. Tests were made only during actual operation by the owner, no plants being started for testing alone. The flat rate charge was based on such tests unless they showed less than three-quarters of the rated capacity of the motor to be in use, in which case three-quarters of the rated capacity was taken as the minimum for motors of over 3 horsepower.

For motors of 3 horsepower or less, the minimum was based on the actual rated horsepower. A meter rate contract with a minimum yearly charge on all size motors of \$24 per horsepower of installed capacity was also in use. This form of rate is of advantage in young orchards where the plant is only partially used.

The rate schedule fixed by the Railroad Commission reduce the contract flat rate for 12 months' service to \$42.30 per horsepower. Flat rates for any number of months' use were also fixed, that for seven months' service being \$29.75 per horsepower. These rates are based upon connected load in motors. Under normal conditions meters will not be installed by the company on strictly flat rate business, but at the consumers' request demand-indicating and watt-hour meters will be supplied at a charge of \$7.50 per year, and the flat rate charges per horsepower of connected load will be readjusted on the basis of 94 per cent demand factor.

A non-contract flat rate of \$7 per horsepower for the first month and decreasing to \$2.30 per horsepower for the twelfth month's service is also provided. The total for 12 months under this rate is also \$42.30 per horsepower, but the consumer is required to pay for the cost of the initial service connection and subsequent disconnections made at his request.

Meter rates on both contract and non-contract basis are also provided. On the contract basis, the demand charge is \$22.05 per horsepower for twelve months' service, plus \$.005 per kilowatt hour. A similar non-contract rate for metered service to that for non-contract service is provided, the demand charge varying from \$4.50 per horsepower for the first month to \$1 per horsepower for the twelfth month, the total for twelve months being \$22.05 per horsepower. The energy charge is also \$.005 per kilowatt hour, the consumer paying the cost of connection.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.

(Continued.)

General Features of all Projects.

The present scope of this report will not permit discussion in detail of all the projects which came under my examination, and I shall therefore review, under the general caption above, those features which are common to all, and to a certain extent identical for all the projects. Unnecessary repetition in considering the individual projects will thus be avoided.

Accompanying maps.—Illustrating the text of this report is a general map of the Pacific Northwest, which was previously referred to in the general report, showing the locations and areas of possible irrigation pumping projects, and a tabulation herewith showing all important data relating to these irrigation pumping projects such as areas, rainfall, water duty, unit costs, power requirements, etc.

Transportation facilities.—Reference to the map will indicate what these facilities are, but in general it may be said that the projects herein considered lie immediately along the Columbia River and Snake River Valleys, and that this region is served by the Spokane, Portland and Seattle Railway, the Oregon-Washington Railroad and Navigation Company, the Northern Pacific Railway, the Chicago, Milwaukee & St. Paul Railway, and by navigation on the Columbia River. At least two, and in most instances three of these lines of transportation service are available to all the projects as will be readily noted on the map.

Soil.—More or less important differences in soil conditions were noted on the different projects. These differences relate chiefly to the relative proportions of sand and loam contained in the soil, to the character of sub-soil and to the fineness of soil texture. In general, however, the soil of most of the projects may be described as a sandy volcanic loam, usually not much in excess of three feet in depth and usually underlain with strata of sands and gravels. These varying conditions, particularly that of fineness of texture, have an important bearing upon the moisture retentive capacity of the soil and they were given special consideration in fixing upon the duty of water.

Climate.—The climatic conditions are such as to make successful agriculture absolutely dependent upon irrigation. An average annual precipitation of about 9 in. and long hot summers with mid-day temperatures frequently above 100 deg. F., are the dominant climatic characteristics of the major part of the area under consideration.

Crops.—From the extensive experience already had in irrigated agriculture along the Columbia River Valley, it is known that all the deciduous fruits such as apples, pears, peaches, plums, etc., do well in these soils and this climate and that grapes, berries, vegetables and all the forage crops, particularly alfalfa, are successfully and profitably grown. Despite the fact that soil and climate conditions are well adapted to fruit culture and certain localities particularly so, experience has shown that mixed farming is the more dependable over long periods of time and therefore on each project it was assumed that forage crops would constitute a considerable portion of the culture. The

Land values.—Prices at which raw lands are now held vary largely according to their accessibility to and their altitude above available pumpage water supplies. The higher bench lands are held at figures that range generally from \$10 to \$25 per acre, while the low lands along the river bottom are held at figures which range generally from \$25 to \$75 per acre. This feature of raw land values is one of much importance to any program of irrigation development by pump-

Storage.—A few of the projects examined seem to offer some possibilities of storage. To the extent that good storage could be developed there would be created a demand for winter power that otherwise might not be utilized and its tendency would be to slightly reduce the annual cost of power to the project. It would also provide a certain margin of safety against a possible break-down of the pumping plant during the irrigation season. In addition to its cost, an adverse effect of such storage would be to reduce the irrigable area of the project, because these reservoir sites all embrace good irrigable lands which form part of the general body of land of the project. It should be stated further that the feasibility of these reservoir sites have not been proven and it is quite possible that their careful examination, by means of borings, would prove them to be infeasible. The reservoirs also would be fed, not by gravity supply, but by pumpage from the same source that the irrigable lands would be directly served and there would therefore be no reduction in total power consumption per year if indeed there were not a slight increase. In view of these conditions I have ignored the matter of storage in developing present cost estimates for the projects, and attention is called to it here merely as a possibility which, in some instances, might render the project somewhat more feasible.

Estimated costs.—The estimated costs, as shown in Fig. 40, include not only the pumping plants, including stepdown transformers, but also all other features of the irrigation project. These estimates, in the absence of actual surveys, are necessarily rough approximations but they constitute the best basis now

Tabulation of Data relating to Irrigation Pumping Projects

Name of Project	State	Source of Water Supply	Area in Acres Gross Irrigate Forage	Crops Fruit Vegetables	Mean Annual Precipitation	Irrigation Season From To	Water Duty Delivery Range	Av. Evapora. loss Max. Mean	Approx. Annual Consump. of Water Cusecs G.A.P.	Trans- mission Distance Miles	Approx. Cost of Complete Project per Acre	Annual Cost of Maintenance per Acre \$ 1/2 1/2 1/2	Cost of Power for the Project per Acre \$ 1/2 1/2 1/2	Power Consump- tion in kWh per Acre per Year	Installation Expense if New \$ 1/2 1/2 1/2									
Grand Dalles	Washington	Columbia River	3000	2000	40%	60%	16.9	Apr. 15 Oct. 15	21'	2,625	520	373	16.1	1200	3	\$ 77.	\$ 875	16.00	\$ 880	0.365	2,825,000			
Hoosier Flat	"	"	1100	1000	60	40	10.0	"	"	24	2,670	245	245	8	400	45	60.	535	11.95	942	0.398	945,000		
Horse Heaven Slope	"	"	76300	61000	60	50	9.6	Feb. 15	"	31.	38 ^{1/2}	394	300	593	33400	95	61.	664	13.43	990	0.306	108000000		
Berrier Slope	"	"	6100	4300	50	50	9.3	"	"	30.	37 ^{1/2}	494	367	41.	2800	95	63.	770	14.50	980	0.324	8550000		
Three Rivers Slope	"	Snake River	49500	42000	50	50	20	"	"	33.	41 ^{3/4}	487	343	435	28500	94	58.	863	14.98	1085	0.360	85750000		
Pasco	"	Columbia River	100000	80000	60	40	7.5	"	"	33.	41 ^{3/4}	355	265	833	41700	126	50.	659	12.92	1038	0.341	126500000		
Benton	"	"	146000	109000	60	40	8.0	Apr. 1	"	40.	50.	362	225	1438	61200	157	48.	730	12.60	1083	0.375	177000000		
Prent Rapids	"	"	128000	112000	60	40	7.0	"	"	37.	46 ^{3/4}	420	316	1369	82000	170	49.	938	14.02	1109	0.379	240000000		
Beverly	"	"	5000	4000	50	50	7.5	Apr. 15	"	36.	45.	150	100	52	1000	173				11.62	2448	2600000		
Between Miller & Arlington	Oregon	"	1000	50	50	12.5	"	"	"	24.	26 ^{1/2}	100	60	7 ^{1/2}	100	12,445				9.50	0.401	260000		
Arlington Gulch	"	"	900	600	50	50	9.4	Apr. 1	"	27.	32.	340	281	5 ^{1/2}	300	49	75	6.74	16.49	975	0.375	780000		
Willows Slope	"	"	5200	1600	60	40	9.1	"	"	28.	33	403	353	14	1000	55	91	7.60	18.59	982	0.364	2700000		
Castle Rock Slope	"	"	172000	150000	60	40	8.6	Feb. 15	"	38.	48 ^{3/4}	457	381	1820	130700	91	65	10.10	17.21	10.00	0.330	400000000		
" (Alternative)	"	"	62000	50000	60	40	8.6	"	"	38.	48 ^{3/4}	310	310	608	357000	91	52	8.46	14.06	10.00	0.332	108300000		
Between Grand Valley & Coconino	Or. & Wn.	"	10000	20	80	26.0	May 15 Oct. 1	15.	18.	600	250	77	360	56,75				9.00	0.490			7000000		
Blalock Island	"	Col. River & Wells	4500	2500	40	60	9.7	Feb. 15 Oct. 15	32.	40	50	40	24.	285	77	45	2.78	7.72	10.19	0.364			835000	
Portington Island and other islands near Porters	"	"	1500	40	60	9.0	"	"	"	30.	37 ^{3/4}	50	40	14.	165	105				14.00	0.415			488000
Attalo Land Co.	Washington	Columbia River	35000	50	50	7.1	"	"	"	32.	40.	60	50	35	330	149			12.40	0.412	1000000			
Burbank Co.	"	Snake River	14000	50	50	6.7	"	"	"	32.	40.	85	75	140	2000	126			10.51	0.345	6100000			
Parsof Steel Co.	"	"	13000	50	50	6.3	"	"	"	30.	36	120	110	117	2400	126			10.80	0.352	7400000			
Manford	"	Columbia River	15000	60	40	7.0	Apr. 1	"	"	40.	50.	68	58	198	2220	161			12.24	0.428	6000000			
Harwin Irr. Co.	"	"	6000	60	40	7.0	"	"	"	36.	45.	85	75	71	1000	158			11.70	0.402	2915000			
Beverly Land Co.	"	"	1200	50	50	7.1	Apr. 15	"	"	36.	43 ^{3/4}	85	75	15 ^{1/2}	220	173			11.62	0.454			565000	
Total exclusive of Grand Rock Island (Alternative)			635700											36500								108513000	253000	

available for judging the feasibility of the project, so far as such feasibility may be indicated by cost. Where so many projects are being considered and under the conditions indicated it should not be expected that future detailed investigation of any individual project will exactly confirm the figures herein given. These figures, however, are believed to be large rather than small, and viewed as a whole in respect to their bearing upon the Celilo development they may safely be accepted as conservative.

Annual charges.—It will be noted in Fig. 40 that the annual cost of maintenance and operation is given under two conditions for each project. The first covers only the cost of power, attendance at pumping station and the ordinary repairs and up-keep of the pumping plant and the general irrigating system. It excludes the items of depreciation, interest and taxes upon the assumption that the former will be met by special assessments when required, and the latter two items will be charged against the land and not against the irrigation project, it being not unusual to include the actual cost of irrigation works in the value of the land for general taxation purposes.

The cost under the second condition includes all of the above, also interest at 6 per cent and taxes at 1 per cent on the total investment and depreciation varying from 4 to 6 per cent, depending upon the character of the works employed. The first condition, therefore, represents the minimum charge that would need be made each year against the landowner to meet the immediate cash outlay for maintenance and operation, while the second represents the total cost of such maintenance and operation if the irrigation works be considered as an entity apart from the land.

(To be continued.)

The electric output of the various power plants of the United States Reclamation Service operated in 1914 was over 66,000,000 kw.-hrs. The total capacity of the 12 plants in operation was 27,134, kw., and the first cost of the plants \$2,542,000. Of the total output, 39 per cent was sold to customers, 32 per cent was used for irrigation pumping, 17 per cent for construction purposes, 4 per cent for drainage, the remaining 8 per cent represented losses. It was estimated that the power remaining undeveloped on all the different projects amounted to a total of 489,000 h.p. Of this 360,000 h.p. consisted of the estimated capacity on the Flathead River in Montana, the remainder being distributed through 21 other power sites.

Direct telephone connections with all parts of irrigation systems is coming to be recognized as a necessity. This is essential both for routine distribution of water on large systems and also for emergency use at time of accidents to the canal. On the projects of the United States Reclamation Service over 2500 miles of telephone line are in use. The average cost of this, including telephones, has been \$160 per mile. On the different projects the acres served per mile of telephone varies from 300 to 1500, being smallest on those systems having long diversion canals, and largest for the more compact projects. The average for the operating projects is one mile of telephone line to about 700 acres.

OIL WELL MOTOR EQUIPMENTS.

BY W. G. TAYLOR.

(These data on horsepower requirements and kilowatt-hour consumption for drilling, pumping and cleaning California oil wells are taken from a paper presented at the thirty-third annual convention of the American Institute of Electrical Engineers, Cleveland, Ohio, June 27-30, 1916. The author is engineer with the power and mining department of the General Electric Co. at Schenectady.—The Editor.)

Oil well motors are called upon to perform three groups of duties,—drilling, pumping and cleaning. The most logical method of applying motors to these operations is to use a different machine for each of the three groups, as this not only involves the least complication in design, but also requires the minimum investment by the oil company, consistent with efficient operation. It has, however, been found more practical in most cases to use one motor for the drilling process and another for all the work involved in pumping, pulling and cleaning the wells.

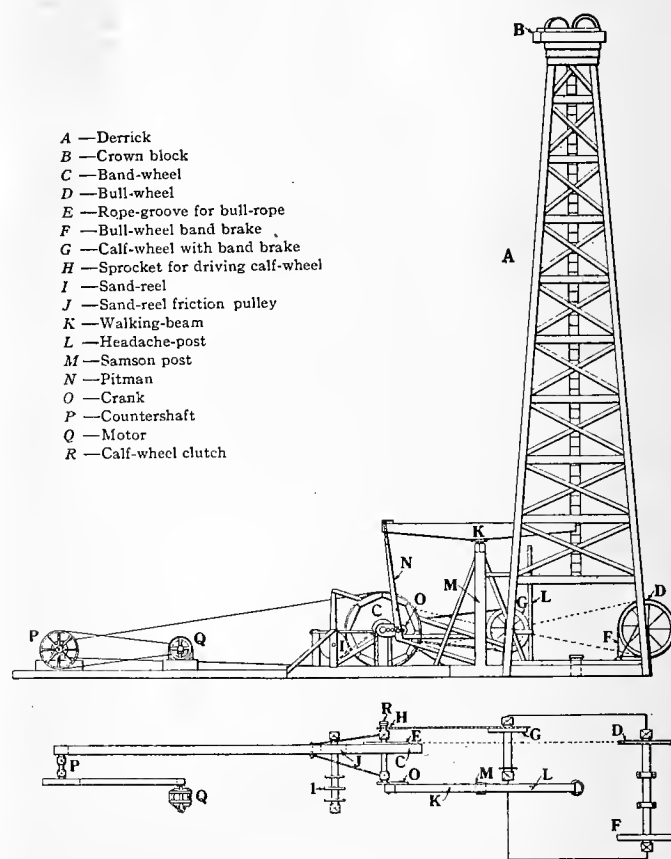


Fig. 1. Elevation and Plan of Motor-Driven Standard California Oil Well Pump.

Drilling.

The arrangement of the standard motor-operated drilling rig used in the California field is illustrated in Fig. 1. The heaviest work is "spudding in" the case which requires continued reversing of the motor under heavy load. The motor should have ample margin in torque to accomplish this without overheating or stalling, as failure to free the string of casing compels the operator to continue with a smaller diameter.

Less power is required to swing the tools during actual drilling, this demand decreasing as the well deepens, because the deeper drilling tools are smaller and a large amount of water is usually carried in the

hole. On the other hand more time and power are required for bailing deeper wells so that the kw.-hr. consumption increases approximately as the square of the depth, barring accidents and extensive "fishing" for lost rope, tools or damaged casing. The average is about 234 kw.-hr., varying between 135 and 400 kw.-hr., depending upon the class of work.

The most successful drilling motors now used in American oil fields are of the slipping induction type with secondary resistance control arranged for reversing duty. A capacity of 50 h.p. is usually sufficient for wells not exceeding 2500 ft. in depth, though cases have occurred where 75 h.p. was necessary on wells

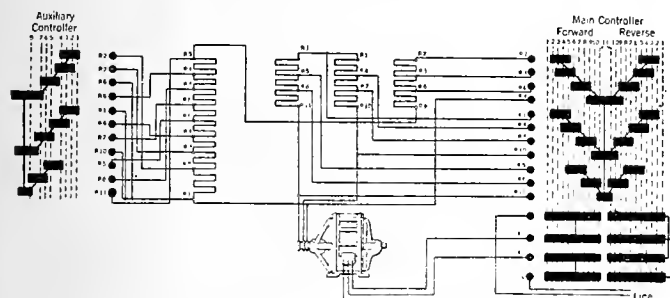


Fig. 2. Connections for Motor Equipment for Standard Cable-Tool Drilling.

from 2000 to 2500 ft. in depth, as well as on the deeper ones. The belted arrangement with a countershaft has proved the best, as the severe service has rapidly put out of commission the various types of gear drive which have been tried.

In the cable-tool method of drilling, the beam must overspeed and allow a relatively free drop of the tools on the down stroke to obtain the most effective blow; the motor to accomplish this must therefore slow down on the up stroke and speed up on the down stroke. This is quite successfully accomplished by so proportioning the pulleys that the motor will have some secondary resistance in circuit when running at the correct drilling speed. There is also required a very fine adjustment of speed to make the movement of the beam accord with the natural period of vibration of the drilling line due to its elasticity. Failure to obtain the exact speed results in deadening the movement of the bit and may strain the line and rig dangerously. A suitably designed liquid rheostat would be an ideal method of control if it received the necessary attention and a good quality of water, but unfortunately neither of these can be given until the usual conditions in the oil fields and so drum controllers have been adopted, connected as shown in Fig. 2. The main controller gives a coarse variation of speed and reverses the motor, and the auxiliary controller provides a means of obtaining fine speed control between the points on the main controller for either direction of rotation. These controllers are each operated by wire ropes extending to the headache-post in the derrick, the arrangement in this respect being similar to the method of throttle control employed with engine-driven rigs.

Pumping, Pulling and Cleaning.

Pumping is accomplished by means of a deep-well pump of the plunger type which is lowered on the end of a string of tubing to a sufficient depth to insure ample submersion. The plunger is operated by jointed

iron or wooden rods extending down within the tubing and attached to the end of the walking-beam or to a pumping-jack operated from a central power-head. The flow of oil through the tubing to the surface is governed by suitable check valves in the barrel and plunger of the pump.

The rods and tubing must be frequently removed to clean out the well or to replace broken or worn parts, and the bull-wheel is then employed except where the use of pumping-jacks makes a portable hoist necessary. Rods are pulled with a single line, but a block and tackle with two or three lines is necessary for the tubing. Both are removed in lengths approximately 60 ft. long which usually consist of three 20 ft. sections screwed together. Bailing, light redrilling, washing or swabbing may be employed in the process of cleaning.

There is no apparent way to calculate the power necessary to pump a well which will give figures uniformly consistent with actual tests, because of the difficulty of determining the effect of varying well conditions. For instance, a large amount of sand in the oil will increase the power necessary to pump it, while on the other hand gas may be present which will help lift the oil. The following summary of records from over 200 California oil wells pumped on the beam, gives an idea of the motor load for pumping alone:

Depth of wells.....	900 to 3100 ft., ave. 1430 ft.
Length of stroke.....	29 to 32 in.
Strokes per min.....	20 to 30, ave. 24.
Diameter of tubing.....	3 in.
Power required.....	1 to 5 h.p., ave. 3.5 to 4 h.p.

Where changes are frequently taking place in well conditions such as the rate of oil flow, the amount of sand with it, the amount of gas or water in the oil, the viscosity of the fluid or the condition of the pump itself, it is necessary to have a variable speed motor to permit the operator to pump at what he considers is the maximum economical rate, which may be limited by the rate of oil flow or the rapidity with which the rods and plunger will drop in the oil on the down stroke. On the other hand there are many cases where squirrel-cage motors meet all the requirements of pumping.

Pulling the rods and tubing is ordinary hoisting work, carried on at a maximum speed of the band-wheel which may be from 50 per cent to 100 per cent higher than the pumping speed. It demands an intermittent motor output of from 35 to 80 h.p. or even higher under some circumstances. A high torque machine is therefore most suitable. The greatest heating of the motor occurs when handling rods, because of the frequent reversals which may occur from three to five times a minute for an hour and a half to two hours at a time. Low armature inertia is consequently desirable. Pulling tubing requires the highest torque and determines the size of motor necessary. The rating usually given the motor for this duty is merely nominal, as the maximum torque obtainable is the determining feature. The maximum load is that encountered when lifting together the rods and pump and the tubing full of oil. In determining the motor capacity it is convenient to use the following formula for the horsepower required to lift tubing at a uniform rate of speed:

$$h. p. = \frac{W \times d \times N}{63,000 \times L}$$

in which W = weight lifted in lbs.

d = diameter of bull-wheel shaft in inches.

N = rev. per min. of bull-wheel

L = number of lines used in the tackle.

The constant 63,000 is based on a mechanical efficiency of the rig of 50 per cent, which is a fair assumption for the majority of cases. In addition to the value obtained from this formula there must remain a sufficient margin in torque for acceleration. This depends largely upon the flywheel effect of the motor armature, as the revolving parts of the rig have relatively small inertia.

Of the various operations of cleaning a well, swabbing requires the heaviest demand of power. The work consists of lowering a plunger into the well casing and then pulling it out. The plunger has a tight fit in the casing so that the suction thus produced draws the sand out of the perforations at the bottom and thus clears the oil passages. The operation may be performed for several hours at the rate of two to four times per hour, each hoisting trip of the swab requiring several minutes. Peak inputs to the motor from 40 to nearly 70 kw. have been recorded in this work.

The total monthly power consumption for all the work of pumping, pulling and cleaning a well will vary from approximately 1350 to 6000 kw.-hr. but the average is about 2100 kw.-hr.

The necessity of employing a single motor for all of the work of pumping, pulling and cleaning is due chiefly to the impracticability of using a portable hoisting equipment for wells that may have to be pulled every few days, particularly where the country is rough; and the desire of most operators to have a machine which will take the place of the steam engine with little or no change in the method of operation.

The most successful and most widely used induction motors for this duty are of two types, the "Y-delta" and the two-speed. Except in special instances both are of the slip-ring type, the former being designed for changing the normal capacity by a change in stator connections made by a suitable switch, this not, however, affecting the speed; the latter has a pole-changing switch mounted on the frame by means of which both the speed and capacity are changed. Both machines require a controller and secondary resistance for speed variation, which with the two-speed motor are effective on either the high or the low speed connection, as a six-phase rotor winding is used. A synchronous speed of 900 or 1200 r. p. m. is usually selected for either type of motor, and a half-speed connection is used on the two-speed machine. Various ratings are employed, depending upon what the conditions require, among which are 20/7 h.p., 20/10 h.p., 25/8 h.p. and 30/15 h.p. Smaller motors than these generally cannot develop the overload torque occasionally necessary in emergencies on nearly all wells. The low capacity is used for little else but pumping, and the design is therefore made for as high an efficiency as possible on this connection with-

out sacrificing the required torque on the higher rating. The maximum momentary capacity is from 300 per cent to 450 per cent of the high rating, but full-load efficiencies of from 75 per cent to 85 per cent, and power factors nearly as good, are nevertheless obtained at full load on pumping duty.

With the Y-delta motor, a high speed for pulling can be obtained only by changing the pulley or by lagging up the bull-wheel shaft to a large diameter. Few operators care to be bothered with the pulleys, while there are some who will not consider the other method because of the increased strain on parts of the rig. Lagging the bull-wheel shaft furthermore does not speed up the sand-reel, so bailing must be done very slowly. But where the operator will use a lagged shaft and has no sand-reel, the Y-delta motor does very well, except for one point which in many cases is important. It is very often the practice to "shake-

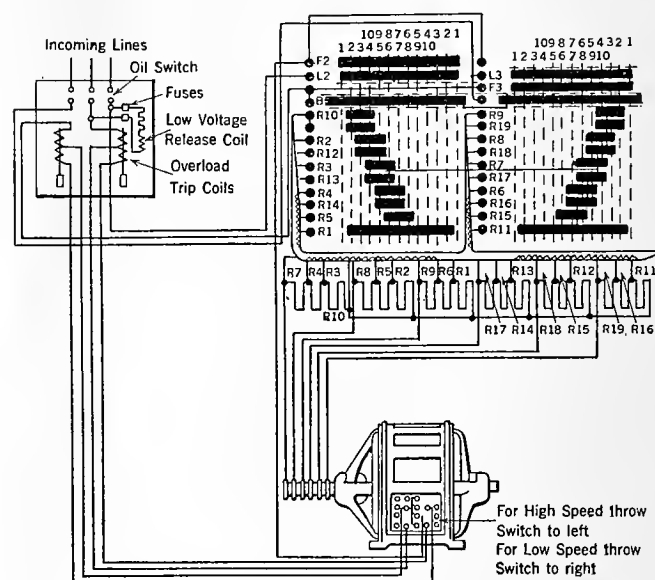


Fig. 3. Connections for Two-Speed Motor Equipment for Pumping, Pulling and Cleaning Duty.

up" a well to free the pump valves from sand and thus avoid pulling the rods and tubing. This is accomplished by increasing the speed of the walking-beam for a few minutes, but there is no practical way to do so with this type of motor, as the time required to change pulleys makes this method out of the question. The two-speed slip-ring motor, as may readily be seen, overcomes all these difficulties and has therefore received wide-spread approval by practical oil men.

The connections of the two-speed equipment in Fig. 3 shows the method of protecting the double-rated motors by double-bound overload trip coils on the oil switch, which are so interlocked by connections with the switch on the motor that proper protection is automatically obtained. The controller is operated by a rope wheel from the derrick as described for the drilling motor.

While the majority of installations use a belted motor with countershaft, there are many back-geared machines in operation. Oil men display a preference for the former, but as most of the gear noise has been recently eliminated by the use of cloth pinions, it is anticipated that more of these will be used in the future.

THE OREGON WATER CODE AND THE SUPREME COURT OF THE UNITED STATES.

BY A. E. CHANDLER.

(This cogent analysis of the present status of the determination or adjudication of water rights in Western states is inspired by recent decision of the U. S. Supreme Court upholding the Oregon Water Code. The author is a member of the California Water Commission and a recognized authority on water law.—The Editor.)

As previously stated in these columns, the three essentials of an effective "water code" are: first, the control of new appropriations; second, the determination or adjudication of existing rights; and third, the distribution of water among those entitled to its use. The last of the three is the real goal to be sought, the other two being but means to that end. Students of water right legislation have been in accord for many years regarding the best method of securing the first and third essential (in order of enumeration), but there has been a decided disagreement as to the best method of making a determination or adjudication.

The first of the western states to provide a special statutory procedure for settling water right conflicts was Colorado. By its acts of 1879 and 1881 the entire state was divided into districts and a procedure adopted for the adjudication of all of the rights to the use of the waters of a stream within a district in a single action in the district court—special provision being made for the taking of testimony before referees. The weakness of the Colorado method was (and is) the fact that the state was not represented in the adjudications and most of the earlier decrees were excessive, that is, not only were the amounts of water decreed not based upon beneficial use but very often a ditch was given an amount equivalent to many times its capacity.

Wyoming in 1890-1891 sought to improve upon the Colorado method by providing a board of control, composed of the state engineer and four division superintendents, and giving to it the authority to make determinations of existing rights. Actual surveys of ditches and irrigated land are made by the state engineer and the evidence regarding priority presented by the claimant on a simple form called "proof of appropriation." After the survey is completed for an entire stream and all of the proofs assembled, the latter, at a time and place duly advertised, are thrown open to public inspection. If a claimant desires to contest the claims of another, a hearing before the division superintendent is held after notice properly given. At such hearings stenographic reports are made of the testimony submitted. The board of control, with the surveys, proofs and testimony before it, makes a determination of the priority and amount of each appropriation and issues certificates in accordance therewith. Such determination is final unless an appeal is taken to the courts.

The Wyoming method is well called "the administrative method." It has worked admirably and comparatively few cases have been appealed to the courts. So novel an institution could not be expected to stand long without an attack being made upon its validity, but the Supreme Court of Wyoming, in *Farm Investment Co. v. Carpenter* (61 Pac. 258), in very positive language upheld the act on every point presented.

The method was adopted in Nebraska in 1895. It has worked effectively there and has been upheld repeatedly by the Supreme Court of Nebraska. Nevada followed the lead of Wyoming and Nebraska in 1903.

The congressional Reclamation Act was passed in 1902. On account of the millions thus made available for expenditure in irrigation works, it offered a material incentive to the western states to clarify the water right situations so that the Reclamation Service would the more speedily approve projects. Although the Wyoming method of water right determination had worked so well in both Wyoming and Nebraska, other states hesitated to accept it on the grounds that it was administrative and not judicial. They accordingly passed legislation providing for surveys and assembling of hydrographic data by the state engineer but also providing for a regular suit to be brought against all claimants by a representative of the state. Such legislation was adopted in Idaho and Utah in 1903, in North Dakota, Oklahoma and South Dakota in 1905 and in New Mexico in 1907. As stated above, the "administrative method" was upheld by the Supreme Courts of Wyoming and Nebraska. The "judicial method" has, however, been declared invalid by the Supreme Courts of Idaho and South Dakota, and has produced practically no results in the other four states above mentioned.

Irrigation had created so little stir in Oregon prior to the passage of the Reclamation Act (June 17, 1902), that practically no stream measurements had been made on Oregon streams by the United States Geological Survey. After the passage of the Reclamation Act, the state became very active along irrigation lines and took immediate steps towards introducing a modern water code. In 1905, the office of state engineer was created, but little other effective water legislation was enacted. In 1907 an attempt to pass a bill, similar to the Idaho and South Dakota acts, failed, but in 1909 the present "water code" was adopted. The code follows the Wyoming act very closely—in fact, whole sections are actual copies. The distinctive feature of the Oregon code is the last step in the method of adjudication. It is exactly the same as the Wyoming method up to the determination of existing rights by the board of control (now called the "water board" and composed of the state engineer and the two division superintendents). Instead of allowing the board's determination to stand until appealed, the Oregon statute provides that it shall be passed to the circuit court, with the surveys, proofs and evidence upon which it is based, to be affirmed or modified after consideration by the court in a comparatively simple proceeding.

The Oregon code has been before the Supreme Court of Oregon a number of times and its provisions have been upheld. It was recently considered by the United States Supreme Court in the case of *Pacific Live Stock Co. v. Lewis*, decided June 5, 1916. As has been stated above, the Wyoming or "administrative" method of water right determination is the one which has produced satisfactory results. The states following the "judicial method" have recognized the results but have doubted the validity of such procedure. Idaho and Utah now have commissions at work preparing recommendations for new legislation

They will be joined by those interested in California and Washington in welcoming the decision in the Pacific Live Stock Co. case, as the United States Supreme Court therein upholds the Oregon code. As above stated, Nevada introduced the Wyoming method of determining water rights in 1903. A decision of the Supreme Court of Nevada in 1914 indicated that such determinations could not be considered conclusive. In 1915 the Nevada act was amended so that the system there is now identical with the system in Oregon.

The recent decision of the United States Supreme Court is, therefore, of so far reaching importance that the following extracts (comprising about 70 per cent of the complete opinion) are printed instead of a brief abstract. It is certain that the clear language of Mr. Justice Van Devanter will commend itself to all interested in the development of our water resources:

PACIFIC LIVE STOCK CO., vs. JOHN H. LEWIS, JAMES T. CHIN- NOCK, and GEORGE T. COCHRAN- constituting the State Water Board of the State of Oregon, et al. (June 5, 1916.)	}	Appellant, Appeal from the Dis- trict Court of the United States for the District of Or- egon.
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Mr. Justice Van Devanter delivered the opinion of the court.

This is a bill in equity to enjoin a proceeding before the State Water Board of Oregon looking to the ascertainment and adjudication of the relative rights of the various claimants to the waters of Silvies River in that state, the grounds upon which such relief is sought being (a) that it is essential to protect a jurisdiction previously acquired by the District Court, and (b) that the local statute, 3 Lord's Oregon Laws, Title XLIII, Chap. 6; Laws 1913, Chaps. 82, 86 and 97, authorizing and controlling the proceeding, is repugnant to the due process of law clause of the Fourteenth Amendment. * *

* * * A general outline of the statute, as it has been construed by the Supreme Court of the state, will serve to simplify the questions to be considered. It recognizes that in Oregon rights to use the waters of streams for irrigation and other beneficial purposes may be acquired by appropriation, adopts a comprehensive scheme for securing an economical, orderly and equitable distribution of the waters among those entitled to their use, incidentally prescribes a mode of determining the relative rights of the various claimants to the waters of each stream, and in large measure commits the administration of the scheme to the State Water Board and officers acting under the supervision of its members. When one or more users of water from any stream request it, the board, if finding that the conditions justify it, is required to set in motion a proceeding looking to an ascertainment and adjudication of all rights to the waters of that stream. Every material step in the proceeding is to be attended with notice and an opportunity to be heard, the adequacy of which is manifest. * * * The board is then to examine all the evidence, make findings of fact therefrom, enter an order embodying the findings and provisionally determining the relative rights of the several claimants, and transmit the evidence and a copy of the order to the circuit court of the county wherein the stream or some part of it lies. Exceptions to the board's findings and order may be presented to the court and in disposing of them the court is to follow as near as may be the practice prevailing in suits in equity. All parties in interest, including the board as representing the state, are to be fully heard.

Further evidence may be taken by the court, or the matter may be remanded with directions that additional evidence be taken and that the matter be again considered by the board, in which event the evidence and a copy of the further order of the board are to be transmitted to the court as in the first instance. In short, upon exceptions the court may re-examine the whole matter and enter such decree as the law and the evidence may require, whether it be an affirmance or a modification of the board's order. And even where no exceptions are presented a decree giving effect to the order is to be entered, that is to say, the matter is not to be left as if the order in itself constituted an effective adjudication. * * *

* * * At the time the statute was adopted, and continuously until this suit was begun, there were pending undetermined in the District Court two suits in equity brought by the present plaintiff, one against two Oregon corporations and the other against another corporation of that state, in each of which suits the relative rights of the parties thereto in the waters of Silvies River were in controversy. These rights are reasserted and again brought in controversy in the proceeding before the board.

When that proceeding was first set in motion, the Pacific Live Stock Company, the plaintiff in this suit, presented to the board a petition and bond for the removal of the proceeding, or a part of it alleged to involve a separable controversy, to the District Court of the United States upon the ground that it was a suit between citizens of different states. But the attempted removal was not sustained, for the District Court remanded the proceeding and in that connection held that while it was pending before the board it was essentially preliminary and administrative, and not a suit at law or in equity within the meaning of the removal statute, 199 Fed. 495.

Thereafter the plaintiff presented to the division superintendent a sworn statement of its claim, accompanied by the fee prescribed—at the same time protesting that the fee was extortionate, that the matter should be adjudicated in the Federal Court, and that the local statute was repugnant to the Fourteenth Amendment. More than two hundred other claimants also appeared and submitted statements of their claims, all being described as higher up the stream than that of the plaintiff. When the statements were opened to public inspection many contests were initiated. Several of these were against the plaintiff's claim; a large number were by the plaintiff against other claims, and there were others in which, it is said the plaintiff was not directly concerned. It was at this stage of the proceeding, and before any evidence was taken in any of the contests, that this suit was brought.

Upon the assumption (1) that the removal proceedings were effective, (2) that the proceeding before the board is substantially identical with the pending suits, and (3) that the proceeding is essentially judicial in its nature, the plaintiff insists that the continued prosecution of the proceeding before the board constitutes an inadmissible interference with the District Court's jurisdiction and that this jurisdiction should be maintained and protected by an appropriate injunction. The insistence must be overruled, because the assumption upon which it rests cannot be indulged. * * *

* * * The proceeding sought to be enjoined, although in some respects resembling the prior suits, is essentially different from them. They are merely private suits brought to restrain alleged encroachments upon the plaintiff's water right, and, while requiring an ascertainment of the rights of the parties in the water of the river, as between themselves, it is certain that they do not require any other or further determination respecting those waters. Unlike them, the proceeding in question is a quasi public proceeding, set in motion by a public agency of the state. All claimants are

required to appear and prove their claims; no one can refuse without forfeiting his claim, and all have the same relation to the proceeding. It is intended to be universal and to result in a complete ascertainment of all existing rights, to the end, first, that the waters may be distributed, under public supervision, among the lawful claimants according to their respective rights without needless waste or controversy; second, that the rights of all may be evidenced by appropriate certificates and public records, always readily accessible, and may not be dependent upon the testimony of witnesses with its recognized infirmities and uncertainties, and, third, that the amount of surplus or unclaimed water, if any, may be ascertained and rendered available to intending appropriators. * * *

* * * In such a proceeding the rights of the several claimants are so closely related that the presence of all is essential to the accomplishment of its purpose, and it hardly needs statement that these cannot be attained by mere private suits in which only a few of the claimants are present, for only their rights as between themselves could be determined. As against other claimants and the public the determination would amount to nothing. And so, upon applying the test before indicated, it is apparent that the assumed substantial identity between the proceeding and the pending suits does not exist.

* * * As an alternative to its first contention, which we hold untenable, the plaintiff insists that the statute is repugnant to the due process of law clause of the Fourteenth Amendment, first, because it requires a claimant, at his own expense, to assert and prove his claim before the board, and to pay an extortionate fee for having it considered,—all under penalty of forfeiting his claim if he refuses,—notwithstanding the board acts only administratively and its findings and order are not conclusive; second, because it permits the board to accept and act upon the sworn statements of claimants taken ex parte and upon the data set forth in the unsworn report of the engineer, without, as is asserted, affording any opportunity for showing their true value, or the want of it, by cross examination or otherwise; and, third, because it requires that the board's findings and order, although only administrative in character, be followed and given effect in the distribution of the water pending the action of the circuit court upon them.

A serious fault in this contention is that it does not recognize the true relation of the proceeding before the board to that before the court. They are not independent or unrelated, but parts of a single statutory proceeding, the earlier stages of which are before the board and the later stages before the court. In notifying claimants, taking statements of claims, receiving evidence and making an advisory report the board merely paves the way for an adjudication by the court of all the rights involved. As the Supreme Court of the state has said, the board's duties are much like those of a referee. (And see *Oregon R. R. & N. Co. v. Fairchild*, 224 U. S. 510, 526-527.) All the evidence laid before it goes before the court, where it is to be accorded its proper weight and value. That the state, consistently with due process of law, may thus commit the preliminary proceedings to the board and the final hearing and adjudication to the court is not debatable. And so, the fact that the board acts administratively and that its report is not conclusive does not prevent a claimant from receiving the full benefit of submitting his claim and supporting proof to the board. That he is to do this at his own expense affords no ground for objection; on the contrary, it is in accord with the practice in all administrative and judicial proceedings. The fee alleged to be extortionate is a charge graduated according to the amount of land irrigated under the claim submitted, and

is fifteen cents per acre for the first hundred acres, five cents per acre for the next nine hundred acres, and one cent per acre for any excess over one thousand acres. * * * In our opinion, the charge is not extortionate and its exaction is not otherwise inconsistent with due process of law.

Upon examining the statute and the decisions of the Supreme Court of the state construing and applying it we are persuaded that it is not intended that the board shall accept and act upon anything as evidence that is devoid of evidential value or in respect of which the claimants concerned are not given a fair opportunity to show its true value, or the want of it, in an appropriate way. On the contrary, the statute discloses a fixed purpose to secure timely notice to all claimants of every material step in the proceeding and full opportunity to be heard in respect of all that bears upon the validity, extent and priority of their claims. And while it is true, according to the concessions at the bar, that the sworn statements of claim are taken ex parte in the first instance, it also is true that they are then opened to public inspection, that opportunity is given for contesting them and that upon the hearing of the contests full opportunity is had for the examination of witnesses, including those making the statements, and for the production of any evidence appropriate to be considered. Thus the fact that the original statements are taken ex parte becomes of no moment. And while it is true that the state engineer's report is accepted as evidence, although not sworn to by him, it also is true that the measurements and examinations shown therein are made and reported in the discharge of his official duties and under the sanction of his oath of office, and that timely notice of the date when they are to begin is given to all claimants. The report becomes a public document accessible to all and is accepted as prima facie evidence, but not as conclusive.

* * * Considering the nature of the report and that claimants may oppose it with other evidence, it is plain that its use as evidence is not violative of due process. *Meeker & Co. v. Lehigh Valley R. R. Co.*, 236 U. S. 412, 430.

The provision that the water shall be distributed in conformity with the board's order pending the adjudication by the court has the sanction of many precedents in the legislation of Congress and of the several states, notably in the provision in the Interstate Commerce Act directing the orders of the commission shall be effective from a date shortly after they are made, unless their operation be restrained by injunction. These legislative precedents, while not controlling, are entitled to much weight, especially as they have been widely accepted as valid. Although containing no provision for an injunction, the statute under consideration permits the same result to be reached in another way, for it declares that the operation of the board's order "may be stayed, in whole or in part" by giving a bond in such amount as the judge of the court in which the proceeding is pending may prescribe, conditioned for the payment of such damages as may accrue by reason of the stay. It is not, therefore, as if the requirements were absolute. As has been seen the order is made only after adequate notice and full opportunity to be heard, and when made is, with reason, deemed prima facie correct. It relates to flowing water, to the use of which there are conflicting claims. Unless diverted and used the water will pass on and be lost. No claimant is in possession and all assert a right to take from the common source. In this situation we think it is within the power of the state to require that, pending the final adjudication, the water shall be distributed, according to the board's order, unless a suitable bond be given to stay its operation. Such a requirement is not arbitrary, does not take from one and give to another and is not otherwise offensive to a right conception of due process.

RATES FOR ELECTRIC COOKING AND WATER HEATING.

(The question of the proper rates to be charged for this class of service is herein discussed and illustrated by several examples. This article is an excerpt from the report of the Electric Range Committee of the National Electric Light Association.—The Editor.)

The sub-committee on the above subject consulted with the same companies as the merchandising committee and secured the following information:

The companies replying served a population of 2,781,420 and have 195,353 urban residential consumers and 16,937 rural residential customers; climatic conditions varied from a maximum of 115 degrees Fahrenheit in summer to —40 degrees in winter; the months in which heat is required in the home varied from 3 to 12; this plainly shows that each company must take these varying conditions into consideration in making rates for this business.

Approximately 47 per cent of the companies reporting have hydroelectric current only, 27 per cent steam, 13 per cent combination steam and hydroelectric plants and 11 per cent purchase current. The source of power has not, apparently, affected the rates made for electric cooking; however, flat rates for water heating are made almost entirely on the part of hydroelectric plants.

But little difference was noted in the prices of competing fuels as between urban and rural districts, which indicates that companies with large transmission lines serving both classes of territory should make the same cooking rates over the whole system.

Only two companies report their peak-load as occurring during daylight hours, the others report the peak between the hours of 5:00 and 8:00 p. m., and results obtained from cooking and water heating installations indicate that this peak overlaps or coincides with the previous system peak.

Approximately half of the companies report their district building up during 1915, and the others report their district stationary.

The companies report only 21 per cent as many electric water heaters in use as there are electric ranges.

Research work done by the committee indicates that the installation of an electric water heater in connection with the electric range reduces the average monthly current consumption of the range from 100 kw.-hr. to 80 kw.-hr., in other words, the range without separate water heaters heats enough water to increase the monthly consumption 25 per cent. The majority of the companies who have secured much water heating use the double-throw switch and find that the maximum kw.-hr. that a range can consume in a month to give satisfactory water heating flat-rate service for the average family is as follows:

Size Water Heater.	Kw.-hr. Cons. of Range.
600 watt	125
750 watts	150
1000 watts	200

A considerable number of the central stations are undecided as to the best method for handling electric water-heating and so have not made a special rate for this business.

One central station has concluded that water-heating at the flat rate of \$3 per kilowatt-month, when operated in connection with an electric range and a double-throw switch used so that the heater is not in use with the range, results in a rate of one-half cent per kilowatt-hour.

The companies that have adopted water heating rates consider all such rates as experimental or development rates.

In considering the rate question for water-heating, one must realize with the use of double-throw switches that either the water heater, or the range is on the system peak and also that especially active or long hour range users, who also, presumably, are large water users, do not secure as much hot water from a flat-rate water heater operated with a double-throw switch as does the small or short-hour user of a range.

In considering the question of a combination lighting, cooking and water-heating rate, we face the difficulty of providing a rate which will properly protect the small user of light and yet provide an adequate return to the central station for lighting current furnished the larger homes and at the same time having a rate comparatively simple in form.

Some object to such a rate, especially in the development period of electric cooking, due to the advantages to both consumer and company of having separate bills for lighting and cooking, so as to determine cooking costs. Another serious objection is the difficulty of securing proper registration of lighting loads on a meter large enough to handle the electric range.

Some advantages of a combination rate are the eliminating of the possibility of a customer's having two meters installed securing lighting service on the range meter: the decided advantage such a rate offers in developing, in our customer's homes, the use of all kinds of appliances, small motors and air heaters, as well as encouraging longer hours' use of light; the keeping in service of the electric range all winter, whereas a separate minimum would result in the meter being taken out during the winter months if the coal range is used for heating the kitchen.

Most central stations are of the opinion that a cooking rate, which economically handles household cooking is sufficiently low to secure electric bake oven business in bakeries, restaurants, cafeterias and hotels, but that a lower rate must be made to secure commercial cooking, i.e., hotel and restaurant cooking where a considerable percentage of the cooking is not done in the oven. Such companies use their power rates for this purpose, the active demand of the range being used in determining the maximum demand charges of the power rate.

Two new rates adopted in the western territory since the Portland report are as follows:

Southern California Edison Company's Rate.

Combination Schedule for Lighting and Heating Service.

For all consumption of electric energy in residences and suites of apartments, through one meter, where an electric range is installed and used for cooking purposes:

- Houses of 8 active rooms and over, first 40-kilowatt hours per month, 7 cents per kw.-hr.
- Houses of 6 and 7 active rooms, first 30-kilowatt hours per month, 7 cents per kw.-hr.

(c) Houses of 5 active rooms and less and apartment house suites, first 20 kilowatt hours per month, 7 cents per kw.-hr.

For all energy used in excess of the number of kilowatt hours per month designated in any of the above classes, 3½ cents per kw.-hr.

Monthly minimum bill \$2.50.

In classifying the houses supplied with service under this schedule bathrooms, halls and cellars will not be included as active rooms.

Pacific Gas & Electric Company's Rate.

The Pacific Gas & Electric Company, San Francisco, has issued a new rate schedule effective February 3, 1916, for electric cooking, heating and power, the rate applying in all territory except in the cities of San Francisco and Sacramento.

The new rate is based on the monthly consumption per meter and is as follows:

4.0c per kw.-hr. for first 30 kw.-hr. of active connected load.
2.0c per kw.-hr. for next 90 kw.-hr. of active connected load.
1.5c per kw.-hr. for over 120 kw.-hr. of active connected load.

Where the consumer signs a contract agreeing to take service for at least twelve consecutive months, the minimum charge will be \$24 for each 12 months' period for the first five kilowatt or less of active connected load, and \$12 per kilowatt for each kilowatt of active connected load in excess of 5 kilowatts. Minimum due and payable monthly.

Where consumer does not sign a contract for at least twelve consecutive months, the minimum charge will be \$2 per month for the first 5 kilowatts or less of the active connected load and \$1.00 per kw. for each kilowatt of connected load in excess of 5 kilowatts.

The active connected cooking, heating and power load shall be taken as 100 per cent of the first two kilowatts installed and 50 per cent of the connected load installed in excess of two kilowatts.

The consumer's wiring for electric cooking, heating and power must be separate from that supplying other service.

Both cases show a reduction as compared with their former rates for this class of business.

The feature of these new rates is the high minimum established and in both cases the minimum is below the normal bill if the range be active.

The following explanation from the Wilmington and Philadelphia Traction Company, of their cooking rate, is of especial interest as this form of rate has not been generally used.

"With an electric range, for instance the General Electric Type R stoves, on which the total connected load is 3.6 kilowatts, we have found that a demand of two kilowatts is very rarely exceeded. In fact our researches into electric cooking, which have extended over a period of some several years back, show that the ordinary household range, as above mentioned, can operate and do all the cooking without materially exceeding the demand of two kilowatts.

"It is generally conceded that with a three-cent rate on this type of range, the consumer's bill would be about \$3 per month or that about 100 kw.-hr. per month would be the average consumption, and our preliminary researches show that this was practically correct.

"The normal demand on a range of this type, taken at about 60 per cent of the capacity of the range is approximately two kilowatts, as above stated.

"We make a contract with the customer, whereby he would pay us a flat rate of about \$3 per month for the operation of this range, during such times as he is operating it at a demand of two kilowatts or less, and would pay a meter rate of 6c per kw.-hr. for the power which is consumed at a greater rate than two kilowatts. For instance, if he operated his range at a load of three kilowatts for less than one hour,

his extra charge would amount to 1 kilowatt hour or 6 cents. In metering this service, we use a standard Westinghouse Type O A watthour-meter, with a special external attachment whereby we can accurately measure the kilowatt hours consumed over and above a predetermined demand.

"The advantages of the flat rate, plus excess schedule, for cooking and heating, are very evident.

"In the first place, a large portion of the rate is definitely determined and therefore can be billed in advance. In the second place a customer will endeavor to keep within the contracted for demand, which, of course, increases his load-factor.

"By the use of the flat rate principle for the first portion of the rate, you get away from the inconsistency of the individual operator, whereby one house will operate economically and have a bill of \$3 whereas a neighbor would not operate economically and have a bill of considerably more. All of this has to be explained and studied out by the central station in order to keep the customer satisfied.

"With the flat rate principle, although one customer might have used a few more kilowatt-hours than another, and pay the same price for it, it is nevertheless true that each customer has the same privilege and could have used a greater or less amount at the same cost, provided they did not exceed the contracted for demand, and it is only the excess that causes the variation in cost. Of course, some customers contract for as little as one and one-half kilowatts; others contract for as much as the full capacity of the range, consequently they cannot have any excess, and we use the same principle in connection with all of our power business and have found it very successful.

"So long as a customer does not exceed the contracted for demand of two-kilowatts, one kilowatt or whatever the demand is they have selected, at the end of the month they only pay the price for the demand, which we base at the rate of \$1.50 per kw. of demand contracted for."

Whether it is desirable to make the combination rate minimum in excess of \$2 per month is questionable, as large minimums will tend to retard securing business.

The following table is herewith submitted to show the average daylight kw.-hr. consumption per residential consumer for a five months' period; also the average kw.-hr. per consumer during the hours of 6:00 a. m. and 6:00 p. m., and the average kw.-hr. per customer consumed during the hours of 6:00 p. m. and 6:00 a. m. It will be noted that a large quantity is consumed during daylight hours.

1915. month.	Average kw.-hr. per consumer.	Average kw.-hr. consumed from 6 a. m. to 6 p. m.	6 p. m. to 6 a. m.
August	13.98	6.58	7.4
September	14.78	5.7	9.08
October	17.95	7.18	10.77
November	21.3	9.8	11.5
December	23.95	11.0	12.95

In conclusion, we are of the opinion that no definite form of rate can be recommended for general use, since local conditions as to cost of current, cost of competitive fuels, forms of other rates, present practice in regard to cash discounts, attitude of regulating commissions, etc., will have to govern each central station in preparing rates for electric cooking.

We do not believe electric cooking in the average sized home can be secured on a three-cent rate; hotel, restaurant and large residence cooking will require a lower rate. A combination rate should be either a load factor rate or some modification, such as room rate, so as to protect present lighting earnings, and should have a minimum monthly bill, at least \$2, and possibly larger.

LETTERS TO THE EDITOR.

Seattle Municipal Lighting Plant Losses.

Sir:—Referring to article in the Journal of Electricity, Power and Gas for May 13, entitled "Municipal Light Plant of Seattle Shows Loss for 1915" and, in perusing the figures set up, by the writer of the article, in connection with the operation of this plant, I wish to call your attention to what is a serious error in arriving at the deficit referred to.

The method of debiting Operating Expense with the redemption of the Capital Account, that is, the \$71,000 for the redemption of bonds, is an error in setting up your account as you have to show this deficit. Does the writer of the article know of any public service corporation that is permitted to keep its accounts in this way? After debiting Operation with Depreciation and then making a further debit for the redemption of bonds, is going after Operation rather hard. By eliminating this erroneous charge of \$71,000, the department does not show the loss referred to.

Is it not a fact that the Cedar River Dam, to which you refer relative to interest charge, was built as much for the use of the water department as for the light department of the city of Seattle? This being so, would it be fair to charge the interest on this investment entirely to the light department?

Relative to the rates for street lighting, is it not a fact that the Seattle rate is no higher than the average rates paid by Pacific Coast cities excepting possibly the municipal plants of Tacoma, Alameda and Riverside?

As a reader of your journal, I think that all of your readers are entitled to the facts in connection with this matter, and that you owe it to them to make the necessary corrections in the statements referred to.

Yours truly,

C. W. KOINER.

Pasadena, Cal., June 15, 1916.

Sir:—I have yours of the 16th instant with copy of letter from C. W. Koiner of Pasadena, criticizing the article which appeared in your May 13th issue, entitled "Municipal Lighting Plant of Seattle Shows Loss for 1915." I am glad to answer the questions which he has put up to you and give you the facts herewith.

The item of \$71,000 paid out of the earnings of the Seattle municipal lighting department to redeem bonds in 1915 was not shown in the article as an operating expense by the writer, but was deducted from the balance after operating expenses had been taken out, to arrive at the net "balance for reserve and contingencies" and was so designated in the article. This net balance, of course, shows the true surplus available for dividends, new construction or betterments. One cannot eat his pie and still have it to eat at some future time. Mr. Koiner asks the question, "Does the writer of the article know of any public service corporation that is permitted to keep its accounts in this way?" The answer is, that the Public Service Commission of the State of Washington, requires every public service corporation in the state, under its jurisdiction, to arrive at the surplus for reserve and contingencies in this manner.

It is not a fact that the Cedar River dam was built as much for the use of the water department as for the lighting department. The bonds for this dam were voted by the people for the improvement of the lighting department power supply, and the interest on these bonds is paid out of the earnings of the lighting plant. The lighting department has never attempted in any way to saddle any of the dam charges onto the water department. No plans or schemes of the water department ever contemplated a dam at Cedar Lake for the extension of the water supply of the city. All such plans have figured on using Swan Lake, some nineteen miles below the Falls and past which the water supply pipe lines run, as a storage basin. The dam was built to raise Cedar Lake and create a storage basin for the lighting department, while the water department, not requiring a high head to operate its system, figured that it could at very little expense, at any time in the future, divert the Cedar River flow to Swan Lake, a natural reservoir basin, without incurring the large expense of a dam at the Falls, which was only necessary for the further development of the Cedar Falls power plant. But, during the past week, a committee appointed by the city council has recommended the expenditure of upwards of eight million dollars to improve the water supply of Seattle, and these improvements contemplate the use of Swan Lake as a reservoir, ignoring entirely the Cedar Falls dam as playing any part in the water supply system.

It is not a fact that the Seattle street lighting rate is no higher than the average rate paid by Pacific Coast cities. The truth is that almost without exception the street lighting rate of Seattle is the highest on the coast. On May 8, 1915, a committee appointed by the city of Spokane to investigate the desirability of establishing a municipal lighting plant in that city—the committee consisting of the commissioner of public works, corporation counsel, water superintendent and city engineer (the latter signing the report), all of them advocates of municipal ownership—submitted the result of their investigation. I quote as follows from their report:

"The price paid for street lamps in all the cities of the Pacific Coast, except Seattle, is around \$60 per arc lamp per year. The city of Seattle is paying the highest rate for street arc lamps of any city in the Northwest, its price being 4½¢ per kilowatt hour for the current used. I find that the cost per arc lamp for the city of Seattle would be approximately \$84 per year as against \$48 paid in Spokane. This is the highest rate paid for lighting at any point that I have been able to locate out of 120 cities in the United States."

The arc lamps have very largely been discontinued and large nitrogen units substituted. These cost less to maintain than the arc lamps and yet the rate of 4½¢ is still being continued. The private company is furnishing street lights in 54 cities and towns around Seattle and in the Puget Sound country at less than the rate paid by the taxpayers of the city of Seattle to their municipal plant. There may be some cities in California paying a higher rate for their street lighting than that paid in Seattle, but there certainly are none in the states of Oregon or Washington.

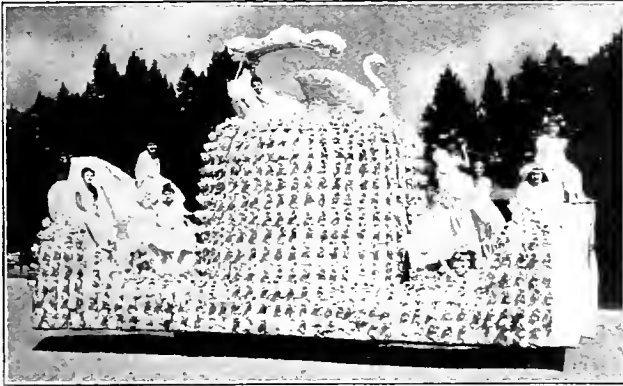
Yours very truly,

W. G. GRAMBS.

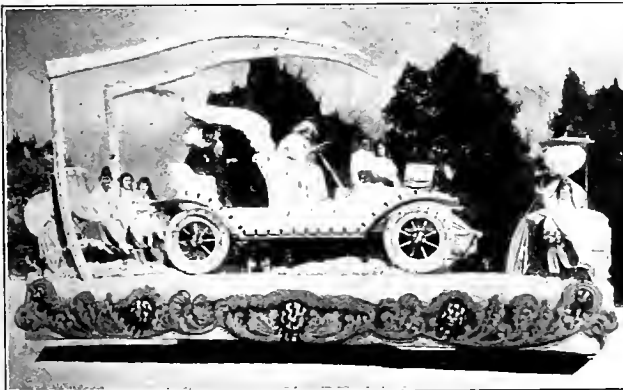
Seattle, Wash., June 20, 1916.

LOS ANGELES ELECTRICAL PAGEANT.

A splendid electrical pageant was presented at Los Angeles several times during the recent conclave of the Knights Templar. Sixteen beautiful floats, allegorically representing "The Flight of the Hours," from "Peep o' Day" to "Father Time," were



"Peep o' Day."



"Father Time."

mounted on trolley trucks furnished by the Los Angeles Railway and paraded through the city. The floats were designed by Fawcett Robinson and were equipped with many mechanical devices. J. L. Clark, superintendent of the electrical repair department of the Los Angeles Railway, had charge of the electrical features, with H. A. Heur as chief electrical inspector.

Fish in irrigation ditches are bothering Forest Service officers, who say that thousands of trout placed in western streams by the Government are killed through being carried into the ditches and washed out on the fields. There are not less than 1200 irrigation projects on or near the national forests, and in many places the loss of trout is heavy. The amount of water used in irrigation, it is said, often determines the advisability of artificially stocking the streams. Where much of the water is used for irrigation, unless the ditches are screened, the trout enter and are washed out on to the fields. While fish are said to make good fertilizer, officials think that trout are too expensive to be used for that purpose.

Most of the states in the West have laws requiring that ditches be screened, but these laws are seldom enforced. The farmers are said to dislike the screens, because they collect drift—wood and trash—which prevents the free flow of the water. Very often, too, it is stated, the farmers can supply their families with a mess of fish by collecting the trout which are found in the fields.

TRANSCONTINENTAL WAVE TRANSMITTERS.

Through the courtesy of the Pacific Telephone & Telegraph Company a picture is shown herewith of the



Telephone Transmitter Recording the Roar of the Pacific.

apparatus installed on a bluff near the Cliff House, San Francisco, to transmit the sound of the waves of the Pacific Ocean during demonstrations of transcontinental telephoning. At this point the roar of the waves can be picked up for transmission at any time during either high or low tide, and yet the apparatus is beyond the reach of the waves. The location was selected after several unsuccessful efforts, in one of which the entire apparatus was washed away, and in another the engineer was swept from the rocks. After excavating a portion of the rock a concrete pier was built as a support for a double iron box housing the three special transmitters used for this purpose.

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This issue of the Journal inaugurates a plan to hereafter give especial emphasis to irrigation matters.

Announcing an Irrigation Department

In the past, while no single periodical has allotted more space to the subject of Western irrigation than this journal, no regularity has been observed in its publication. Hereafter, this lack will be met by a regular department conducted under the direction of Professor S. T. Harding of the irrigation department of the University of California.

Professor Harding is well qualified for this work. He has had a wide practical experience in both government and private service, and combines with this the rare faculty of being able to impart his knowledge to others. Readers may confidently rely on his selection as to what is best in recent irrigation methods and practices.

The series of articles which will constitute this department will be concerned primarily with the use of power in irrigation and drainage and will include accounts of methods for developing underground waters, the design, construction and operation of pumping plants and the conveyance and use of pumped water. By this means not only will the irrigation engineer be given a new source of information, but the agricultural power salesman will find practical instruction on irrigation matters, thus enhancing his ability to interest irrigators in the increased use of electric power.

Electricity and irrigation are closely associated in nature. Storage of flood waters for the development of power also conserves the flow for irrigation needs. Hydroelectric power is largely responsible for the habitability of former arid areas now reclaimed by electric pumping. Electric power also has been of potent service in the reclamation of flooded or water-logged lands. So this additional matter in no way interferes but really assists in the Journal's established policy of helping to upbuild Western power developments.

Another nail has been driven into the coffin of the doctrine of riparian rights in Western states by the decision of the United States Supreme Court in upholding the legality of the Oregon water code, as is clearly pointed out by A. E.

Legality of Water Appropriation

Chandler elsewhere in these columns. The conflict between the theory of riparian rights and the practice of prior appropriation has been long and bitter. Riparian rights, though economically weak, have been so strongly bolstered up by legal precedent that their position seemed well nigh impregnable. Consequently the victory in the Supreme Court greatly cheers everyone interested in the betterment of Western water law.

The doctrine of riparian rights is hyphenitic and not in accord with Pacific Coast conditions. It emigrated to this country after the common sense law of

prior use had been established by the early California miners. Under its enactment old titles have been insecure, distribution of water has frequently been inequitable and new developments have been retarded. Like the old man of the sea in the Arabian tale of Sinbad the Sailor, this pernicious doctrine has too long had a strangle hold on legitimate irrigation and power developments. It is high time to cast off the burden.

The Oregon statute went to the root of the trouble and provided a logical procedure for the adjudication of existing rights. After the state water board announces its findings of facts and issues a provisional order the entire matter is reviewed by the circuit court which issues the final order. In this respect the Oregon code provides a model which might well be followed by other Western states, now that its legality has been authoritatively determined.

Last year more than four hundred steam boilers exploded in the United States, killing one-third that number of men and injuring nearly twice as many more. These casualties are criminal. Strictly speaking most of them were not even accidents, as the causes are known and the events could have been prevented by proper precautions.

Providing Boiler Safety

Inasmuch as these precautions have not been voluntarily taken by some boiler owners and operators it has become necessary for the government to protect those who will not protect themselves, and others, against their own carelessness. Many of the Western states, particularly, have established industrial accident commissions to define and enforce standards of safety. The California commission has issued tentative boiler safety orders which are to be submitted for criticism and suggestion on July 8th at San Francisco, and on July 13th at Los Angeles.

These orders comprise the boiler code of the American Society of Mechanical Engineers, together with a few changes, affecting existing installations. They thus demonstrate the benefit to be derived from the labors of the boiler code committee, whose contribution to human welfare has hardly yet been appreciated. The rules provide for an annual inspection, and cover the subjects of inspections, ultimate strength of material used in computing joints, minimum thickness of plates and tubes, specifications of metals used in building boilers, construction and allowable working pressure for power boilers, riveting, calking, requirements for manholes and washout holes, safety valves, water and steam gages, fittings and appliances, hydrostatic tests and such. They apply primarily to stationary boilers of more than eight horsepower and do not govern boilers subject to federal control and inspection.

The most noteworthy feature of these orders is their agreement with standard practice. Practical considerations dictate that uniformity in rules be secondary only to the necessity for legislation. The absurdity of rating a given boiler as safe in one state and unsafe in another is manifest. While geography

may modify the conditions to which engineering facts are applied it can never change those facts.

A most interesting example of how legal limitations may overrule possible equity is found in the Idaho Public Service Commission's decision in the case of the Washington Water Power Company against the Montana Power Company. As the case has to do with the interstate transmission of electric power it will possibly form a precedent for similar cases that may arise in other states.

It seems that the Montana Power Company and the Thompson Falls Power Company, both generating power in Montana, had arranged with several mining companies operating in the Coeur d'Alene district of Idaho, to transmit power from the Montana boundary line across Idaho over a transmission line owned by the mining companies. The Washington Water Power Company, operating an hydroelectric plant in Idaho and heretofore supplying these mining companies with electric power, then complained to the commission that they were thus subject to a form of competition to which the commission had granted no certificate of public convenience and necessity.

The commission neatly side-stepped the main issue by holding that the defendant power companies are not operating in Idaho and therefore are not subject to its jurisdiction and likewise that the mining companies do not come within its control as they are not public utilities. "However, a view of the fact that in the final determination of the case, the findings of the commission as to the character of the defendants may not be sustained, the commission deems it best to pass upon all the material issues raised so that the court may have all the issues before it."

Consequently, the commission finds that the transmission of electrical energy is a transaction of interstate commerce, over which it again has no jurisdiction. Still it does not necessarily follow that the distribution of such energy within the state of Idaho is interstate commerce, although the regulation of such distribution may affect interstate commerce. Nevertheless the commission recognizes that "to hold that electrical energy generated in Montana, or transmitted from Montana, can by reason of that fact be distributed in Idaho for compensation without regulation, while the local distribution of electrical energy generated in Idaho is subjected to regulation, is contrary to public policy."

Yet the commission finally finds that as the "distribution is made by the mining companies for their own use and not for sale to others, the transaction is not a public service under the jurisdiction of the commission." So the complaint was dismissed and the matter left to be taken up with the courts. The immediate lesson to be derived seems to be the necessity for specific legislation in the matter of extending or otherwise defining jurisdiction in such cases. Naturally it is not within our province to pass on the merits of either side's contentions at this time.

Interstate Transmission of Electrical Power

PERSONALS

Leonard Metcalf, consulting engineer of Boston, Mass., is at San Francisco.

R. Q. Cleavenger, Phoenix Glass Company of Pittsburg is at San Francisco.

Earl Wilson, electrical contractor and dealer at Napa, was at San Francisco this week.

D. A. Wagner, manager Electric Agencies Company, San Francisco, is at Los Angeles.

R. N. Tucker, contractor and dealer, Healdsburg, Cal., was at San Francisco this week.

E. D. Pike, manager of Coast Service Stations for the Wagner Manufacturing Company, is at Los Angeles.

H. D. Havey, salesman Electric Appliance Company, has returned to San Francisco from a trip in Nevada.

T. E. Bibbins, local manager of the General Electric Company, has returned to San Francisco from the East.

A. M. Irwin, assistant treasurer of the Westinghouse Electric & Manufacturing Company is at Los Angeles.

F. J. Cram, salesmanager of the Electric Appliance Company at San Francisco, is in camp on the Russian River.

Geo. Kidd, general manager British Columbia Electric Railway Company, Vancouver, B. C., has left for England.

T. H. Nelms, salesman for the Pacific States Electric Company, has returned from a short hunting trip in Marin county.

D. E. Harris, sales manager Pacific States Electric Company, at San Francisco, has left for the east for a month's trip.

Paul V. Quick, with Landers, Frary & Clarke, Universal Electric agents, at San Francisco, left for Salt Lake City this week.

M. A. Bryte, factory agent French Battery & Carbon Company, has returned to San Francisco from the Yosemite Valley.

B. W. Chenoweth, superintendent of plant, Philippine Island Telephone & Telegraph Company, Manila, is in San Francisco.

Wm. Hall of the National Conduit & Cable Company at San Francisco, is spending his vacation at the Yosemite with his family.

Duncan Reynolds of Holabird, Reynolds & Company, of Los Angeles, was in San Francisco on his way back from Del Monte.

H. C. McCutcheon, agent for the Holabird-Reynolds Electric Corporation at Los Angeles, is spending his vacation at San Francisco.

G. P. Egleston has recently been appointed new business agent for the Coast Counties Gas & Electric Company at Santa Cruz, Cal.

Arthur Noyes, salesman for Electric Appliance Company, has returned to San Francisco from a trip to Southern Oregon and Northern California territory.

H. P. Stow, general manager, and **Leo Harris**, of the Thomas Day Company, San Francisco, are making a business trip in auto through Southern California.

Edward D. Brown, superintendent Reno Water, Light & Power Company, was in San Francisco the first of the week, on his return from the Knights Templar Conclave at Los Angeles.

Walter H. Whiteside, formerly president of the Allis-Chalmers Company, and now connected with the New England Westinghouse Company, was in San Francisco last week on his way home.

M. A. Hussey, **E. C. Rounland**, **F. C. Carleton**, salesmen with the Westinghouse Electric & Manufacturing Company, have been guests of the Camera Club at the Yosemite for the past two weeks.

C. W. Mitchell, inspecting engineer with the Board of Fire Underwriters of the Pacific, has returned to San Francisco from an extended trip through northern California, where special activity in dredge construction is noted.

W. P. Naser, manager for the Trumbull Electric Manufacturing Company at San Francisco, has been appointed manager of the company's branch office at Chicago, succeeding **J. S. Jacobson**, resigned. **H. F. Yost** is assistant manager of the San Francisco office.

C. F. Benham, assistant to the superintendent of operation, Great Western Power Company, San Francisco; **N. H. Callard**, salesman Westinghouse Electric & Manufacturing Company, Salt Lake City; **J. H. Corcoran**, division superintendent of traffic, Pacific Telephone & Telegraph Company, Portland; **G. H. Kellogg**, gunner, U. S. Navy, Naval Training Station, San Francisco; **O. A. Kommers**, district agent, San Joaquin Light & Power Corporation, Corcoran, and **G. J. Wheat**, assistant to superintendent of operation and maintenance, Pacific Gas & Electric Company, have been elected associate members of the American Institute of Electrical Engineers.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

The first quarterly convention of the Oregon association of Electrical Contractors and Dealers, was held at Portland on Wednesday, June 28th. The program for the day included open house for all members at the secretary's office during the morning, auto trip over the Columbia Highway during the afternoon, and a banquet at Crown Point Chalet in the evening. **W. L. Goodwin** of San Francisco, founder of the association, was to have been the principal speaker of the evening but was unable to attend.

San Francisco Electrical Development and Jovian League.

Preparedness was again the subject at the league luncheon on June 21st, ranging from discussion of plans for the preparedness parade on July 22 to a stirring address on "Government and Business," by **Samuel M. Shortridge**, the speaker of the day. He stated that business success and the security of human rights are dependent upon the stability of the government. He urged that business men should consequently take an interest in politics, arguing that the relation between government and business is so intimate that one cannot exist without the other. **Mr. Shortridge** is a wonderful speaker and impressed his auditors with the sincerity of his plea. **H. H. Hoxie** of the Electric Railway & Manufacturers' Supply Company, was chairman of the day.

Los Angeles Jovian Electric League.

A program of merit with full measure was provided at the luncheon on June 21st, by the chairman of the day, **Thos. Foulkes** of the Foulkes Electric Company. **W. W. Middlecoff**, a prominent attorney, in a snappy fifteen-minute talk, eulogized Electricity as the symbol of progress; his subject was "Electrifying the Law." He was followed by **Dr. Sam Atkinson**, secretary of the Motion Picture Freedom League, who delivered a lecture on "The Hyphenated American." He showed the difference between the citizen who was foreign born, but had become an American from choice, and the citizen who is an American as a result of the accident of birth. It is his opinion that in the event of an invasion, the foreign born will be just as determined to keep out the invader, as those who have not known another environment but that of this country. He stated that the result of future wars will hinge largely upon general industrial preparedness. In closing he said that the man who will do more to prevent an enemy from entering our country today, is not an army officer, a government official, or a politician, but an inventor—**Thos. A. Edison**.

Pacific Coast Electrical Jobbers.

Pacific Coast electrical supply jobbers and their guests met at Del Monte, June 21-24 to play golf and incidentally transact business.

As regards golf, the third and final match play for the team contest cup was won by the manufacturers. The Pass & Seymour cup was won by Floyd Averill of Portland; the central station cup donated by the jobbers was won by Stanley Walton and the old copper jobbers' cup, which has been the subject of contest for seven years, was won for the first time by C. E. Wiggin with 88 as a net score. The play for the manufacturers' trophy resulted in a tie between J. M. Morris of Los Angeles and T. E. Bibbins of San Francisco.

The several golf trophies, as well as the whist tournament prizes, won by Mrs. R. B. Clapp of Los Angeles and Mrs. Garnett Young of San Francisco, were presented at Saturday night's golf dinner, over which C. C. Hillis presided as toastmaster. The feature of the evening was the putting contest to decide the tie for the manufacturers' cup. Unfortunately Mr. Morris was unable to be present and as Mr. Bibbins plays only with left-handed clubs, it was necessary that only a left-hander could volunteer as a substitute. The honor fell to Sam Taylor. The contestants were forcibly removed from the banquet hall and donned full polo outfits. The contest was to be with polo mallets and polo balls. When the contestants entered the banquet room the guests stood upon their chairs and greeted them with shouts. Neither of the rivals, it seemed, had ever handled a polo mallet or seen a polo ball. Furthermore, Mr. Bibbins having traveled from Hot Springs, Va., to Del Monte to be present at this match, was somewhat fatigued and it was apparent from the start that he was nervous. The putting was fast and furious and at the finish Sam Taylor was declared the winner.

The open meeting Saturday afternoon was one of the most interesting ever held. H. V. Carter had secured as speaker Mr. Russell Lowry, president of the First National Bank of Oakland, Cal., who spoke on "Trade Acceptancy." Mr. Lowry's remarks were from a past master in finance. He said banks, while useful, are not wholly indispensable adjuncts of trade. Commerce in considerable volume was carried on before banks were thought of but the present method of business is almost entirely dependent upon banking accommodations. The constant problem of the commercial banker is to keep his investment liquid and he suggested a new form of commercial paper. The usual promissory note is not distinctively commercial, either in form or substance. Commercial paper which is sold through note brokers differs from the local credit only in that it seeks a wider market. The defect of the system is that there is always a broker willing to sell but no market when the holder wants to sell. As regards paper of a really commercial character this defect has been remedied by the Federal Reserve banks, which cash notes by the process of re-discounting. Notes representing non-commercial transactions still remain unavailable, except by sale or as collateral with correspondent banks. The four or six months' term of credit for single name commercial paper is also too long. In Europe the note is drawn to approximately cover the period necessary for the shipment of goods and their sale by the purchaser. In America, on the other hand, the term of credit has lengthened, while the time consumed in moving goods has been decreased with better transportation methods.

An even greater lack of convertibility is found in mercantile credits carried on open account than is the case with bank credits. In Europe the open account is replaced by the bill of exchange or sight draft with bill of lading. When these documents are presented, the purchaser detaches the bill of lading and writes the word "accepted," with his signature, across the face of the draft, which then becomes a bill of exchange discountable at the bank and thereby convertible into cash.

"A bill of exchange is superior to the promissory note, as we know the latter, in having behind it the responsibility of the maker, the responsibility of the acceptor, and a specific shipment of goods, which presumably are to be resold during the life of this instrument and thereby provide the means of payment.

"Granting that trade acceptances or bills of exchange, or two-name paper by any other name you may prefer, is preferable as a means of settling accounts to ledger entries, what can we do to bring about the desired change in our methods? Most of our two-name paper at present is the poorest paper we have because it represents merely the closing of overdue or doubtful accounts. There is an undoubted prejudice in the minds of business men against signing notes or accepting drafts. They seem to think it is an imputation upon their credit to be asked for paper. This prejudice must be overcome before any real progress is made, and it is not likely business men will exert themselves very greatly to educate their customers unless there is something to be gained by so doing. Here is where the co-operation of the banks must come in. If the banks will say to their borrowing customers, 'We will charge you such and such a rate for your loans, but if you will convert your book credits into negotiable instruments, we will discount these instruments at 1 per cent less than the rate for loans,' an inducement is supplied.

"But there is another aspect to the situation, much more important than the consideration of reducing the costs of business. The creation of the Federal Reserve banks places at the service of trade and commerce not merely a large aggregation of detached and independent banks, but a great banking system—a system whose life blood is commercial paper of the most liquid nature. The ability of this system to serve in fullest measure is dependent upon the volume of the stream of commercial credits which it is able to regulate and influence. The Federal Reserve banks are the reservoirs of credit which absorb the excess volume when the stream is at flood, releasing it gradually as the flood subsides and so keeping an even and dependable flow. How can this be done if business men, mindful only of their own immediate interests, refuse to contribute their quota toward the establishment of a credit system in line with those of other countries, and leave the streams and reservoirs of banking credit dry and barren? Could the Bank of England, during the month of August, 1914, have expanded its loans \$300,000,000, with reserves lowered from 55 per cent to 15 per cent, if there had not been available for discount a broad volume of really commercial paper, known to be liquid in normal times and unquestioned as to value by reason of the strong business houses behind it? And what can the National banks do, in times of emergency, to tap the reservoirs of the Federal Reserve banks, unless proper tapping facilities are furnished by business men, through conversion of their inaccessible credits into liquid and negotiable form?

"The Federal Reserve banks have done their part in offering a lower rate of discount on trade acceptances than on single-named commercial paper, thereby emphasizing the greater desirability of this class of investment."

A very earnest discussion of Mr. Lowry's address then followed and it seemed the consensus of opinion was in favor of working the problem out on a commercial basis. Geo. C. Holberton then addressed the meeting on the subject of co-operation of the jobbers and central station, not only in merchandising for electrical lines but also for gas. The jobbers very heartily offered to perfect a plan of operation with him at once.

Those present included Mr. and Mrs. F. H. Leggett, Mr. and Mrs. R. B. Clapp, Mr. and Mrs. A. H. Elliott, daughter, and Miss Bunnell, Mr. and Mrs. J. C. Manchester, H. B. Squires and mother, Mr. and Mrs. Garnett Young, F. N. Averill, F. G. Beck, R. F. Behan, W. L. Berry, T. E. Bibbins, T. E. Burger, H. V. Carter, H. T. Clark, R. J. Davis, Ira Francis, S. W. Gil-

man, W. L. Goodwin, W. L. Greenfield, S. B. Gregory, W. B. Hall, C. C. Hillis, R. D. Holabird, Geo. C. Holberton, Russell Lowry, H. C. McCutcheon, J. M. Morris, F. H. Murray, F. J. Quinn, S. P. Russell, D. L. Reynolds, H. E. Sanderson, H. B. Squires, E. B. Strong, S. H. Taylor, S. V. Walton, C. E. Wiggin, Carl Young and Garnett Young.

National Electrical Contractors' Association.

The sixteenth annual convention of the National Electrical Contractors' Association of United States, will be held at New York City, July 17th to 22d, inclusive. An electrical exhibit will be held under the management of the Hotel McAlpin during convention week in the terra cotta room of the hotel.

Monday, July 17th—10 a. m.: Meeting of national executive committee.

Tuesday, July 18th—10 a. m.: Meeting of national board of directors.

Wednesday, July 19th—10 a. m.: Opening of convention. Session open to all. Speakers: Address of Welcome, Lewis H. Woods, president New York State Association; response, John R. Galloway, president N. E. C. A.; address, Hon. John Purroy Mitchell, mayor of New York City; address, James H. McGraw, president McGraw Publishing Company, subject, "Electric Merchandising"; address, T. Commerford Martin, executive secretary, N. E. L. A.; address, Arthur Williams, general inspector New York Edison Company.

2 p. m.—Business session. Open to members only.

9 p. m.—Reception and dance—blue and green rooms, Hotel McAlpin.

Thursday, July 20th—10 a. m.: Business session. Open to all in the electrical contracting business, whether members or not.

10:30 a. m.: Ladies to visit and inspect "Altmans."

2:00 p. m.: Business session. Members only.

2:30 p. m.: Complimentary concert tendered to ladies and guests of the Aeolian Company at Aeolian Hall, Forty-second street, introducing the organ, pianola and talking machine.

5:30 p. m.: Automobile trip to Coney Island.

Friday, July 21st—10 a. m.: Business session for members only.

3 p. m.: Special train on Long Island road, leaving Pennsylvania Station, to Hotel Trouville, Long Beach.

4 to 6:30 p. m.: Surf bathing, etc. at Long Beach.

6:30 p. m.: Dinner-dance and entertainment.

Saturday, July 22d—9 a. m.; Organization meeting of the national board of directors.

10 a. m.: Organization meeting of the national executive committee.

11 a. m.: Leave hotel for special boat, "Seeing New York by Water." A light luncheon will be served on board, landing about four o'clock.

TRADE NOTES.

The Mosso-Berry Electrical Construction Company has changed its name to the Hutton-Tinling Electric Company of Spokane, due to the fact that H. H. Hutton and Hugh. L. Tinling are now in active charge.

Holabird-Reynolds Electric Company have just moved to a new location, 300-302 East Third street, Los Angeles, occupying the entire new building that was built especially for them. This will give about twice the amount of floor space formerly occupied.

The prize washing machine campaign conducted by the Pacific Power & Light Company during the three months ending May 31st, was won by the Prosser office, which sold machines to 3 per cent of its consumers. The total number of machines sold was 118, of which 20 were sold by Norman H. MacDuff of the North Yakima office.

CALIFORNIA WATER COMMISSION APPLICATIONS.

J. W. Catlett of Pleasant Grove, Sutter county, has applied to the commission for permission to appropriate 400 miners' inches of the waters of the east by-pass of Reclamation District No. 1001, tributary to the Sacramento River. It is intended to divert the water by means of a concrete flume, with removable flash boards. A canal, a half a mile long will convey the water to the lands to be irrigated, which comprise 1280 acres.

The Ivanpagh Valley Improvement Company of Pasadena has applied to the commission for permission to appropriate the surface and subterranean waters, to the amount of two second feet, of Cliff and Boulder Canyon Creeks in San Bernardino county tributary to Dry Lake in Ivanpagh Valley for irrigation purposes. The applicant proposes a pipe line $2\frac{1}{2}$ miles in length, into which the water will be diverted by dams in tunnels under the gravelly bed of the stream. The estimated cost is \$10,000. The acreage to be irrigated is 8000.

W. J. and P. S. Dorris of Alturas have applied to the commission for permission to appropriate 550 acre feet of the waters of Government Corrales Flat, tributary to Rattlesnake Creek in Modoc county. An earth dam 443 ft. long is proposed to divert the water to 400 acres at an estimated cost of \$1100.

Harry Pattison of Crescent City, has applied to the commission for permission to appropriate three second feet of the waters of Haden Gulch, tributary to Hurdy Gurdy Creek, in Del Norte county for mining purposes at the Lucky Strike mines. A ditch $\frac{3}{4}$ mile long is proposed to convey the water to the mines at an estimated cost of \$1000.

The American Trona Corporation, of Trona, San Bernardino county, by S. W. Austin, its attorney in fact, has applied to the commission for permission to appropriate for mining purposes, the waters of Peterson, Argus, Bruce Canyon and Parson Creeks in Inyo county, on the east slope of Argus Mountains. While this application asks for the appropriation of only one half of one second foot of water, its system proposes the use of over 22 miles of pipe line, and an estimated expenditure for getting the water to place of use of some \$8000, which does not include a great deal of work already done and money expended. The nature of the mines to be supplied are potash, borax and soda. The water is to be developed by open pipes and tunnels at eighteen different points and collected in tanks and reservoirs at the mines.

Flory, Culp & Flory of Fullerton, Orange county, have applied to the commission for permission to appropriate the storm water of Black canyon in Mono county for the purpose of irrigating 480 acres of land.

E. H. Dodge of San Francisco, has applied to the commission for permission to appropriate 500 cu. ft. per second of the waters of Lee Vining Creek, in Mono county, for irrigation purposes. The application states that it proposes to construct a main canal 20 miles in length and to water 50,000 acres at an estimated cost of \$200,000. The application covers lands around Mono Lake.

The city of San Luis Obispo has applied to the commission to appropriate five cubic feet per second of the waters of Lopez Creek, tributary to Arroyo Grande Creek for a municipal water supply. Also, that municipality applies to appropriate 8 second feet of Salinas River for like purpose. According to the application it will require nearly 20 miles of pipe line to carry the water from points of diversion to the city.

Some time ago Barclay McCowan of Bakersfield filed an application with the commission for permission to appropriate 10,000 second feet of water in Kern county and has followed it with another for 25,000 cubic feet additional from the Kern River, with a storage of 750,000 acre feet. McCowan states that he is filing for trustee for the people of

Kern county, with the intention of forming a large irrigation district under the state laws. The last application involves 21 townships of nearly 500,000 acres.

A. D. Schindler of San Francisco has filed three applications for permission to appropriate water, with the commission, involving an irrigation district covering 250,000 acres. at a cost if carried out of several millions of dollars. Applicant asks 2000 second feet from the South fork of the Kings River, 2000 from the main Kern River, and 1000 from the Tule and Kaweah Rivers, a total of 5000 second feet, and storage of 300,000 acre feet. The proposed main canals are 90 miles in length. The land to be irrigated all lies in what is known as the Tulare Lake Basin and the application states that it is the intention to form a district to be known as the Tulare Irrigation District.

Wm. M. Cunningham of Topaz, Mono county, has applied to the commission for permission to appropriate for irrigation purposes, four second feet of the waters of Sliknard Creek tributary to West Walker River in the said county. Applicant proposes to convey the water a mile and a half through a ditch to the land to be irrigated.

E. J. Prior of Big Bar, Trinity county, has applied to the commission for permission to appropriate five second feet of the waters of Manzanita Creek, tributary to Trinity River, for mining purposes. Applicant proposes a ditch 3700 ft. long to convey the water to a gravel mine, at an approximate cost of \$500. The water will be returned to Trinity River.

Richard Clayton of Bodfish, Kern county, has applied to the commission for permission to appropriate three second feet of the waters of Erskine Creek, tributary to Kern River for irrigation purposes. He will carry the water diverted to the land to be irrigated by a ditch approximately a mile in length.

Permits.

George Allen of College City, Colusa county, has been granted a permit by the commission to appropriate three second feet of the waters of Reclamation District Ditch No. 108 in that county, for purposes of rice culture. By means of a pumping plant raising the water six feet to a ditch to be a quarter of a mile long, he will irrigate 136 acres.

Thomas Quigley of Gottville, Siskiyou county, has been granted a permit by the commission to appropriate eleven second feet of the waters of Beaver Creek for power purposes. The total fall to be utilized is 80 ft. to develop 160 theoretical horsepower for the purpose of operating a gold dredger. The water is to be carried to the works through a ditch two miles long. Water will be returned to the stream after use. The estimated cost is \$1000.

G. W. Pratt of San Francisco has been granted a permit by the commission to appropriate three second feet of the waters of Sycamore Slough in Reclamation District No. 108 for purposes of rice growing, in Colusa county. By a ditch a quarter of a mile long the water will be brought to 250 acres at a cost of \$1000.

G. W. Layman of Los Angeles has been granted a permit by the commission to appropriate one second foot of the waters of springs in Arctic Canyon, San Bernardino county for irrigation. It is proposed to carry the water through a ditch five miles long to 320 acres at an estimated cost of \$3000.

Elmer E. Mason of Straw, Modoc county, has been granted a permit by the commission to appropriate fifteen acre feet of the run-off of Clear Lake Hills for the purpose of irrigating 30 acres at a cost of \$650.

Ernest A. Schuler of Balls Ferry, Shasta county has been granted a permit by the commission to appropriate five second feet of the waters of Sheridan Creek, tributary to Bear Creek, Shasta county, for irrigation. By a ditch two miles long it is proposed to carry the water to 640 acres to be irrigated, at an estimated cost of \$750.

Samuel P. Hale of San Jose has been granted a permit by the commission to appropriate 4.4 second feet of the waters of Jackson and Hale Creeks in Fresno county for irrigation purposes.

Geo. T. Neasham and E. L. Kafader of Ft. Bidwell, Modoc county, have been granted a permit by the commission to appropriate three cubic feet per second of the waters of Lieberman Creek, tributary to Upper Lake in Surprise Valley, for irrigation purposes. A ditch $3\frac{1}{2}$ miles long will carry the water to 3000 acres at a cost of \$1200.

Joseph H. and Laura B. Meredith of Willow Ranch, Modoc county, have been granted a permit by the commission to appropriate 115 acre feet per annum of Bonner Ravine, tributary to Goose Lake in Modoc county, for irrigating purposes. The water will be carried to 115 acres at a cost of \$1000.

The Frank Shaw Land & Cattle Company of Bishop, Inyo county, has been granted a permit by the commission to appropriate 1110 acre feet of water per annum of Dexter Creek in the county of Mono for irrigation of 1680 acres by means of a ditch two miles long, at an estimated cost of \$6500.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Santa Maria Gas & Power Company to issue and sell \$40,000 face value six per cent twenty year gold bonds. The money will be used for construction purposes.

The commission has approved a form of mortgage and trust deed filed by the Southern Counties Gas Company of California, to secure an authorized bond issue of \$10,000,000.

The San Joaquin Light & Power Corporation has applied to the commission for authority to issue and sell \$1,000,000 par value first and refunding mortgage series C 6 per cent bonds to reimburse treasury for moneys expended in betterments.

The commission has authorized the Los Gatos Telephone Company to sell 150 shares of its capital stock at \$10 a share to take up certain outstanding notes.

The Nevada, California & Oregon Telegraph & Telephone Company has applied to the commission for authority to issue \$15,000 6 per cent bonds at 80 per cent of par to raise \$12,000 to build toll line 25 miles long in Modoc County.

The commission has authorized the Northern Electric Railway Company—Marysville and Colusa branch—to issue its demand notes for \$25,000 at 6 per cent, to take up similar note to the First National Bank of San Francisco. It has also authorized the Northern Electric Railway Company to issue its demand note for \$185,000 at 7 per cent to take up same amount of notes to various banks.

The commission has issued a supplemental order authorizing Western States Gas & Electric Company to withdraw from the Girard Trust Company \$8069.38, part of a trust fund to pay for extensions and betterments.

The San Diego Consolidated Gas & Electric Company and the Oceanside Electric & Gas Company have filed with the commission a joint application for authority for the former to buy, and the latter to sell, all property and rights of the Oceanside Company. The commission heretofore authorized the San Diego Company to buy the entire issued capital stock of the Oceanside Company, 1819 shares, at \$14 a share, and the San Diego Company now says it holds 1699 of these shares and expects to acquire the remaining 120. When this ownership is completed it wishes the property of the purchased corporation conveyed to it.

NEW CATALOGUES.

Westinghouse Motors for Washington Machine Service is the subject of No. 25 in the small motor series published by the Westinghouse Electric & Manufacturing Company.

ELECTRICAL CONTRACTS—PORTLAND, OREGON.

The Morrison Electric Company has the following contracts: Portland Rubber Mills, 368 E. Ninth street; Glafke Warehouse, E. Third and E. Elder streets, reconstruction work for the True Blue Biscuit Company, 414 E. Davis street; Portland Camera Exchange, 386 Morrison street; Freedman Estate Building, Ninth and Davis streets.

Pierce-Tomilson Electric Company is doing the reconstruction work in the old Rambeau Grill at 127 Broadway street.

F. H. Bauman Company wired the new building of the Oregon News Company, 440 Glisan street.

Miller & Halls have the complete electrical contract for both power and light in the electrically driven sawmill being built by the Inman, Paulson Company, Portland, Oregon. In addition to this they have the contract for the electrical equipment of the Wassell Apartments, being constructed at Fourteenth and Clay streets. There will be 53 apartments, each equipped with electric ranges. At the present time they are completing the wiring of the new municipal warehouse No. 1 and a garage on the corner of Broadway and Davis streets.

Vanderlip & Lord have the contract for the wiring in the building being erected on the northeast corner of Ash and Third streets, also F. Lowengart's building at 380 Couch street, and White Company's building, west Park and Couch streets.

The Beauer Electric Company is installing the electric system in O. B. Stubb's Building on the northeast corner of Couch and Fourth streets.

The Coast Steel and Machine Company is installing the electrical equipment in the new building being erected by the Kaola Company at 634 Roosevelt street.

The Ne Page, McKenny Company are doing the electrical work in connection with the remodeling of the Pantages Theater.

C. M. Reardon is doing the electric work in connection with the remodeling of the Orpheum Theater, which is to be now known as the Hippodrome.

BOOKS RECEIVED.

"The Electrical Contractor," by Louis W. Moxey, Jr. 86 pp., 6x9 in. Published by McGraw-Hill Book Co., New York, and for sale by Technical Book Shop, San Francisco. Price, \$1.50.

Herein are presented the essential principles of cost-keeping and estimating, wiring and illumination calculations and other technical problems met by the electrical contractor. They represent the results of twenty years' practical experience. The book contains eight chapters, devoted respectively to profit and overhead expense, bookkeeping, cost-keeping, estimating, calculating wire sizes for both d.c. and a.c. circuits, illumination calculations and general data. Any contractor will find this information to be worth many times the cost of the book.

Walker's Manual of California Securities and Directory of Directors. 586 pp., 6x9 in. Published by H. D. Walker, 454 Montgomery street, San Francisco, and for sale by Technical Book Shop, San Francisco. Price, \$4.00.

The eighth annual number of this standard guide to financial conditions in California, in addition to giving full details as to the bonded indebtedness of the state and three principal cities, list of banks, public service corporation officials, stock and bond issues, and similar information for sugar and oil corporations, for the first time contains a section devoted to irrigation securities. An exhaustive table is also presented of the San Francisco street railway franchise situation, as well as a record of quotations on the San Francisco exchange from January 1, 1905 to April 30, 1916. Brief articles are published on the blue sky laws and the regulation of public utilities.

Standard Methods of Gas Testing, 200 pp., 6½x10 in. U. S. Bureau of Standards, Washington, D. C. Price, 40 cents.

How to measure, determine and test gas for illuminating and heating purposes is here set forth in simple form, technically correct. After suggesting the best location and general equipment of a laboratory, attention is given to the measurement of gas volume by various kinds of meters. Then follows detailed instructions as to the measurement of heating values and the determination of candle power and gas impurities. Meter testing and determination of specific gravity and humidity complete the volume.

"Electrical Engineering," by E. J. Berg and W. L. Upson. 416 pp., 6x9 in. Published by McGraw-Hill Book Co., New York, and for sale by Technical Book Shop, San Francisco. Price, \$4.00.

This volume is based upon lectures in the first course of electrical engineering at Union College, Schenectady, where the authors are professor and associate professor respectively. The purpose is to supplement class-room instruction, recitation and laboratory work by fixing fundamental ideas. This is done primarily by means of problems, typical solutions being given. The treatment is fundamentally concerned with design of motors, generators, lifting magnets and transformers. The principles of each type of apparatus are clearly developed. The mathematical treatment is simply explained, particularly as regards alternating current transmission problems. It is unfortunate that a number of typographical errors in formulas mar the otherwise precise excellence of the work. As a whole, it is particularly well adapted to individual study by engineers who desire to brush up on elementary theory and be informed on the latest developments in electrical engineering.

"The Engineer in War," by P. S. Bond. 187 pp., 5x7½ in., black leather binding. Published by McGraw-Hill Book Co., New York City, and for sale by Technical Book Shop, San Francisco. Price, \$1.50.

This text is the latest addition to the rapidly growing literature regarding the unpreparedness of the United States for military emergency. But unlike many other books, it suggests a practical remedy, particularly as regards the service of engineers, by outlining the essentials of a course of training for an engineer reserve. It is in effect a brief outline of the relation of engineering to the conduct of war and the adaptation of the principles and practices of civil engineering to military requirements. The author is major of the corps of engineers, U. S. A., this book being a reprint, with revisions and additions, of a series of articles published in *The Engineering Record*. The subject matter is divided into eleven chapters. First the military policy of the United States is shown to be behind the times, particularly as regards engineer troops, whose duties are outlined and whose equipment is described. The application of these principles are then illustrated by description of methods employed in crossing streams, by pontoons, bridges and fords, building military roads, carrying on field fortifications and siege operations, and demolishing bridges, railroads and highways. A chapter is devoted to military reconnaissance, sketching and surveying, one to military sanitation and another to the mobilization of material resources. The final chapter tells how engineers and contractors may prepare to meet the military obligations of citizenship by means of study and field training. Then, by examination, engineers can qualify for commissions in the volunteer engineers. The war department's suggested list of military reading for civilian engineers is published as a bibliography. There is also a glossary of military terms employed in the text. From this outline it will be noted that this book forms a most valuable introduction to detailed study of the general subject of military engineering.



NEWS NOTES



INCORPORATIONS.

BIG SANDY, MONT.—The Farmers' Mutual Telephone Company has been incorporated here.

BELLEVUE, IDAHO.—Articles of incorporation have been filed for the Glendale Farmers' Mutual Telephone Company.

SANTA FE, N. M.—The Rosa-Ignacio Telephone Company, organized under the laws of Colorado to operate a phone line between Rosa and Ignacio, Colorado, has been admitted to do business by the state corporation commission. The capital is \$10,000 and Alfred H. Long of Rosa is named statutory agent in New Mexico.

ILLUMINATION.

BRAWLEY, CAL.—A new lighting system will soon be installed in Brawley by the Holton Power Company.

GRESHAM, ORE.—A franchise has been granted to the Portland Gas & Coke Company for supplying Gresham with gas.

SPOKANE, WASH.—The council has declared intention to install an ornamental lighting system on Main street from Division to Monroe streets.

UNIONTOWN, WASH.—This city is expected to install a street lighting system. The Washington Water Power Company is rebuilding its lines through this place.

EL PASO, TEXAS.—The building committee of the Mt. Sinai temple has awarded the contract for electrical fixtures for the new synagog to the Lawrence Electrical Company.

CERES, CAL.—A contract for lighting the streets of Ceres for five years has been awarded to the Yosemite Power Company. The company is to install a new system under the contract.

STANWOOD, WASH.—Warner Marshall of Boston appeared before the council recently with a proposal to take over the Stanwood Light & Power Company if the city would give him a franchise.

LOS ANGELES, CAL.—The city attorney has been instructed by the council to prepare a contract for cable for use in the lighting systems at Echo and Sycamore Grove parks with the Standard Underground Cable Company.

NEWPORT BEACH, CAL.—The board of trustees has bought the artificial gas generating plant from the bondholders of the West Coast Gas Company and has leased the distributing system within the city and on Balboa Island.

SAUSALITO, CAL.—A contract has been entered into with George L. Fish to install a gas distributing system. The rate is not to exceed \$1 per 1000 ft. It is thought the system will in the course of time be extended to Belvedere, Tiburon and Mill Valley.

HAYWARD, CAL.—The chamber of commerce has appointed Victor Lagrave, Jesse H. Woods and H. Holmes a committee to confer with the town trustees regarding the inauguration of an electrolier lighting system on the principal business streets.

CALEXICO, CAL.—It is stated that the new power plant of the Holton Power Company will be completed within 30 days. In addition to the new plant near Holtville, the company will have its gas and electric reserve plants at El Centro completely renovated and remodeled, greatly improving its equipment and service in the valley.

EL PASO, TEXAS.—The Parsons Gold Mining & Milling Company has purchased the Alto Light & Power Company's light and power plant, and will operate it on a much larger scale than formerly. They are preparing a foundation for a new 500 kw. turbine and for other machinery to be installed. The plant will continue to be operated under the name of the Alto Light & Power Company.

FRESNO, CAL.—About 6200 ft. of laterals from the gas main in Arlington Heights will be laid by the Pacific Gas & Electric Company, through the Alta Vista tract as one of the extensions that are contemplated in their \$20,000 estimates for improvements in Fresno. A 4 in. main will be laid from Seventh to Eighth streets on Ventura. Two 125 h.p. boilers in the west Fresno plant will be replaced by one 450 h.p. boiler at a cost of about \$13,500.

TRANSMISSION.

PRINCE GEORGE, B. C.—Sealed proposals for equipment for the power plant will be received by the city clerk, John A. Turner, up to July 8th.

LENOX, MONT.—It is reported the Helena Light & Railway Company of Helena plans the extension of its electric-lighting lines to Lenox. W. L. Callaghan is manager.

WOODLAND, CAL.—The Northern California Power Company has applied for a franchise for transmission lines in Yolo County. Bids will be received for said franchise up to July 11th.

OAKLAND, CAL.—Representatives of the Glen View and Montclair Improvement Clubs have appealed to the city council to have the wires of the Great Western Power Company placed underground in the Fourth Avenue Heights district.

OAKLAND, CAL.—The Pacific Gas & Electric Company has laid a high power electric cable carrying between 3000 and 4000 horsepower under the estuary immediately east of the plant of the Union Iron Works on the Alameda side of the estuary.

KINGMAN, ARIZ.—Surveying of a new power line 8 miles in length to run north from Gold Road vicinity and tap the Union Pass district, has been started. The company also contemplates the construction of a line about a mile in length to supply power to the Pioneer and Paramount mines near Oatman.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company is constructing a transmission line, which begins at Springville and will end at the Mohrland and Blackhawk mines in Carbon county. The line will run by way of Helper and will be approximately 100 miles in length. The cost will be in the neighborhood of \$500,000.

FRESNO, CAL.—The San Joaquin Light and Power Company is preparing to make extensions in the Fresno district that will cost approximately \$75,000. It is reported that about 65 miles of new lines will be put in, divided as follows: Fresno, 10.3 miles; Selma, Caruthers and Riverdale, 9 miles; Midway, 7½ miles; Corcoran, 3¼ miles; Bakersfield, 5.2 miles; Madera, 4.8 miles; Dinuba, 2.3 miles; Merced, 3.6 miles; Livingston, 5 miles; Los Banos, 6 miles; Santa Maria, 7 miles.

WILLIAMS, CAL.—Local employes of the Northern California Power Company have figured the cost of the proposed extension from Arbuckle to Dunnigan at \$20,000. The voltage between here and Arbuckle will be raised from 6,600 to 11,000, making it necessary to enlarge the transformers at Arbuckle. The line at present ends at College City, three and a half miles east of Arbuckle. This will have to be practically rebuilt on account of the higher voltage. Ten and a half miles of new line will have to be built from College City to Dunnigan.

OCEANSIDE, CAL.—A. S. Glasgow, resident manager of the Oceanside Electric Company, announces that in addition to the installation of a 24-hour service of electric current in Oceanside, important improvements are to be made in connection with the operation of the plant under the new man-

agement of the San Diego Consolidated Gas & Electric Company. Surveys have been completed for building a line from the end of the San Diego company's present power line in Del Mar to Oceanside, material for which has been purchased. It is expected that the Del Mar-Oceanside line will be completed by August 1st.

THOMPSON FALLS, MONT.—It is reported that by September 1, 1916, the Holter plant of the Montana Power Company, near Thompson Falls, Mont., will be furnishing not less than 50,000 h.p. It is understood the third and fourth units are now being installed, and that each of the six units which will comprise the completed plant will furnish 6250 kw. The work is being rushed at the plant, and plans for the construction of a high-power transmission line up Cow Creek and over the divide to Saltese are being prepared. The line to Saltese will supply current for operation of trains over the line of the Chicago, Milwaukee & St. Paul Railway Company.

SPRINGFIELD, ORE.—The board of directors of the Oregon Power Company has authorized the construction of an electric transmission line which will connect the system in Marshfield, Ore., with Coquille and Myrtle Point, two towns which were added to the Coos Bay (Marshfield) Division of the company about two years ago. This transmission line will traverse a distance of about eight miles between Coquille and a lumber camp of the C. A. Smith Company, now served electrically by the company over wires owned by the former. Arrangements have been made with the lumber company to use their seven-mile transmission line in conjunction with the company's extension from Coquille to connect the two at present separated systems of the Coos Bay division of the power company. When completed the electrical requirements of Coquille and Myrtle Point will be served from Marshfield, a distance of fifteen miles, and the steam plant located at Coquille will be dismantled.

TELEPHONE AND TELEGRAPH.

FORT BRAGG, CAL.—The district commercial manager of the Western Union Telegraph Company says the company will build new lines to accommodate growing business in this city.

ALTURAS, CAL.—The Nevada, California and Oregon Telephone & Telegraph Company is preparing to build a toll line between Alturas and Cedarville, a distance of 25 miles, at a cost of about \$12,000.

RIVERSIDE, CAL.—O. P. Clark has applied to the board of supervisors for a franchise for the California Southern Railroad Company for a telephone line on highways of this county. Bids will be received up to July 26th.

TRANSPORTATION.

EAST SACRAMENTO, CAL.—The Pacific Gas & Electric Company is preparing for the double tracking of the J street car line east of Clark avenue. The double track system is to be installed on J street to Hale avenue in advance of the street improvement.

SILVERTON, ORE.—It is reported that the Silver Falls Timber Company will electrify its railroad from Silverton to its logging camps and that the Willamette Valley Southern, financed by the Portland Railway, Light & Power Company, will be extended to Silverton before another fall.

LINDSAY, CAL.—Officials of the Pacific Electric Railway and the Southern Pacific Company were in Lindsay recently conferring with citizens relative to the electric railway the Southern Pacific Company propose to build in this section of the valley. The men gave definite assurance that the new line would be decided upon in a short time. The line, it is stated, will tap the Southern Pacific line in this city, and run east to the El Mirador district.

IRRIGATION.

LINDSAY, CAL.—Sealed bids will be received for the construction of irrigation works for the Lindsay-Strathmore Irrigation District up to July 7th.

STOCKTON, CAL.—The bond election of the West Side Irrigation District will probably be held July 15. The estimated cost of the project is \$285,000.

EUREKA, CAL.—Plans are under way for a system whereby the waters of Bull Creek can be used in the establishment of a community irrigation system.

MADERA, CAL.—Webster is to have an irrigation district, residents of the locality having voted in favor of the proposition at a recent election. E. C. Pitman is one of the directors.

TURLOCK, CAL.—Drainage is the biggest problem that is now confronting the Turlock Irrigation District. To accomplish the desired end more than one method of drainage will likely be adopted.

OSWEGO, ORE.—The Oregon Iron & Steel Company is planning an expenditure of about \$400 an acre on irrigation and the installation of electricity, Bull Run water, gas and sewerage in the Dunthorp addition of 500 acres.

LA FAYETTE, CAL.—Preliminary steps have been taken here toward the formation of the Wright Irrigation District of 35,000 acres, including the present Woodbridge irrigation system. It is planned to bond the district for \$300,000 to run forty years.

TERRA BELLA, CAL.—The Terra Bella Irrigation District proposes to construct a system of works to irrigate 12,500 acres of land immediately adjoining the town of Terra Bella. The source of water supply for this land will be the surface run-off of Deer Creek and deep wells located in the valley west of Terra Bella.

FRESNO, CAL.—Two additional surveyors have been sent to Pine Flats by L. A. Nares and I. Teilmann, who own the site where it is proposed to construct a reservoir to store the flood waters of Kings River. The survey is now being made to check up the capacity of the reservoir when constructed at a 300 foot level.

WILLOWS, CAL.—The Northern California Lands Company will soon begin sinking test wells for the purpose of demonstrating the existence of an adequate water supply for the irrigation of the proposed Jacinto irrigation district, which is to include about 20,000 acres of land at the north end of the Sacramento Valley irrigation project.

ANTELOPE, CAL.—Plans are under way for irrigating all of Antelope Valley, an area estimated at about 5000 acres. Engineer E. G. Hopson, formerly of the U. S. Reclamation Service, advised the land owners as to the feasibility of the project. As outlined the project will be accomplished by installing a big pumping station in the Sacramento River at some suitable point. It is estimated that 3000 inches of water will be required for an irrigation season of seven months.

PLACERVILLE, CAL.—Plans for the formation of a great irrigation district by means of which 50,000 acres of fertile land in this county will be irrigated are gaining headway, according to a report submitted to the Chamber of Commerce. The land to be irrigated extends from Clarks-ville to Pleasant Valley and from Webber creek to Cosumnes river. Water is to be drawn from the system of the Diamond Ridge Ditch Company.

LINDSAY, CAL.—The proposed \$1,400,000 bond issue of the Lindsay-Strathmore Irrigation District was carried at the election here. Directors elected are E. L. Daniels, Charles Towt, D. A. Eskert, John Burr and F. M. Pfrimmer. C. W. Wright was chosen secretary and E. B. Gould tax collector. Work is to be started as soon as the bonds can be sold on a system to water 15,000 acres of foothill citrus lands, the contracts to be conditioned on completion of the project by the fall of 1917.

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BY F. D. WEBER.

SEASONAL USE OF WATER.

BY S. T. HARDING.

PROSPECTIVE MARKET FOR IRRIGATION PUMPING.

BY JOSEPH JACOBS.

THE ST. PAUL ELECTRIFICATION.

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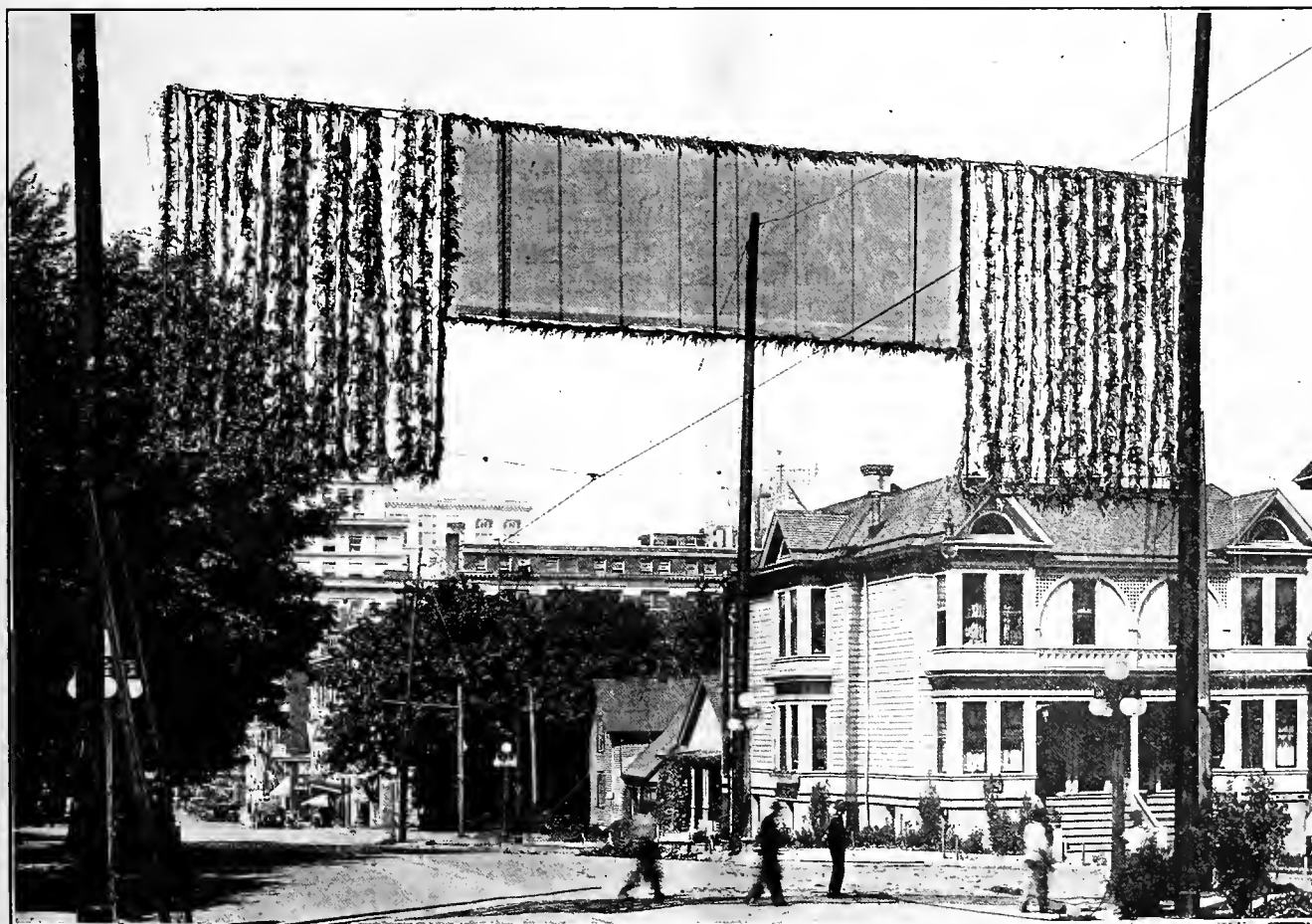
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ELECTRICAL FEATURES OF PORTLAND ROSE FESTIVAL

BY F. D. WEBER.

Every year the question arises how to create new electrical features for the annual rose festival held at Portland, Oregon. This would not be so difficult if the funds were unlimited and the festival was not an annual affair. Consequently, it is interesting to note

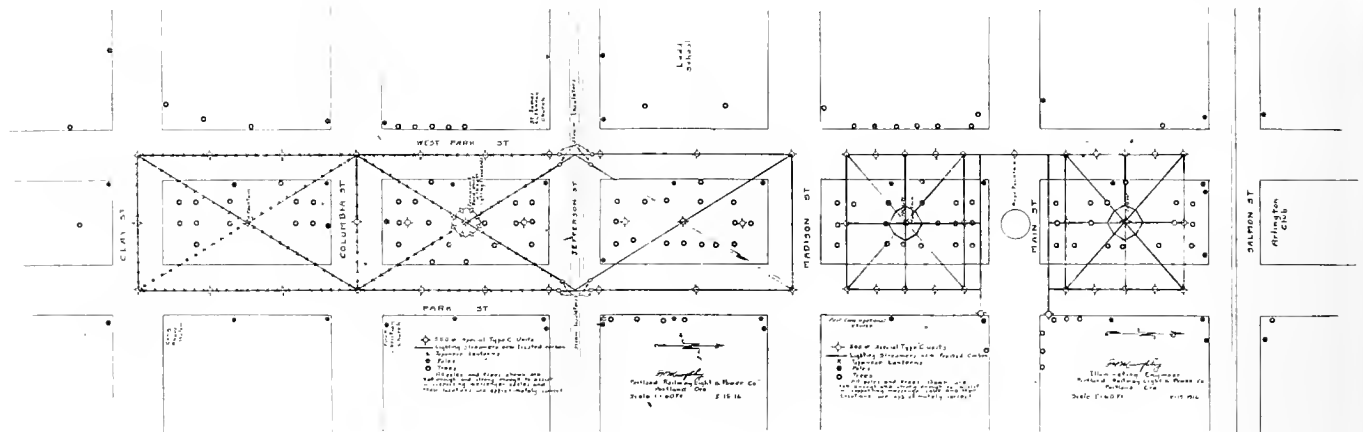
Washington streets two large columns were erected 30 ft. in height. These columns were illuminated by flood lighting and featured paintings presenting the scenic wonders of Oregon. In a niche in each column was a statue of Sacajawea pointing the way to the



Day Picture of Rose Curtain.

what was accomplished this year at a moderate expense. The work was done under the direction and supervision of O. B. Coldwell, Rose Festival director, with the assistance of F. H. Murphy, illuminating engineer, with the Portland Railway, Light & Power Company. Commencing at Broadway and

festival center. Two more columns were erected on Main street between Broadway and Park streets. These columns also showed paintings of Oregon scenery, and in the niches of the figures gave a reproduction of the "Coming of the White Man." This was intended to emphasize the amazement of the Indian



Map of Decorated Section.

at what the white man has accomplished since he first came to the Oregon country.

Between Washington and Main streets, on Broadway, there was a series of chandeliers and canopies at Alder, Morrison, Yamhill, Taylor and Salmon streets. These chandeliers featured cupids and bluebirds suspended in midair from circular frames, the figures swinging with the wind. Each cupid held a flashing torch and jewels sparkled from branches carried in the mouths of the birds. Festoons of jewels were carried about the chandeliers, giving an effect similar to the flashing of precious stones as presented at the Palace of Jewels at the P. P. I. E. The canopies presented a myriad of colored lights forming a perfect dome. Cedar festoons were used about the canopy to cover the framework.

The two columns at Main street served as a frame for the rose fountain in the distance, which was the central floral display of the center. Two electrical curtains served to mark the entrance to the center. One curtain closed off Main street at Broadway and was composed of hundreds of lights and cedar festoons.

Another curtain at Main street built along similar lines, hung across Broadway east to west and featured a mammoth pink rose. In the day time the rose was not visible, but at night flood lights were used to produce the effect of a rose flower blooming in a most artistic and striking manner.

From Salmon street to Jefferson street the illumination of the floral display was such as to bring out the flowers in their true colors. Great curtains of frosted white lights produced this effect. From Jefferson to Clay streets streamers of colored lights and the use of Japanese lanterns served to transform this section of the center into a veritable fairyland. Here the band concerts, dancing and other entertainment features were held.

In addition to the columns, canopies and chandeliers along Broadway electrical streamers completed the picture.

The cluster lights along Broadway fitted into the plan of decoration and colored lights were flashed from the globes.

The decorations were extended along North Sixth street to the depot, making a white way clear to the festival center. Also flag decorations and garlands of evergreens were used in all of the principal streets. These garlands ran the entire length of the blocks and

were caught up at 20 points in each block with a big hanging basket of bright flowers.

Individual property owners in the business section co-operated with the festival management in working out the general decorations and through this co-operation a broad unity in the decoration scheme was achieved.

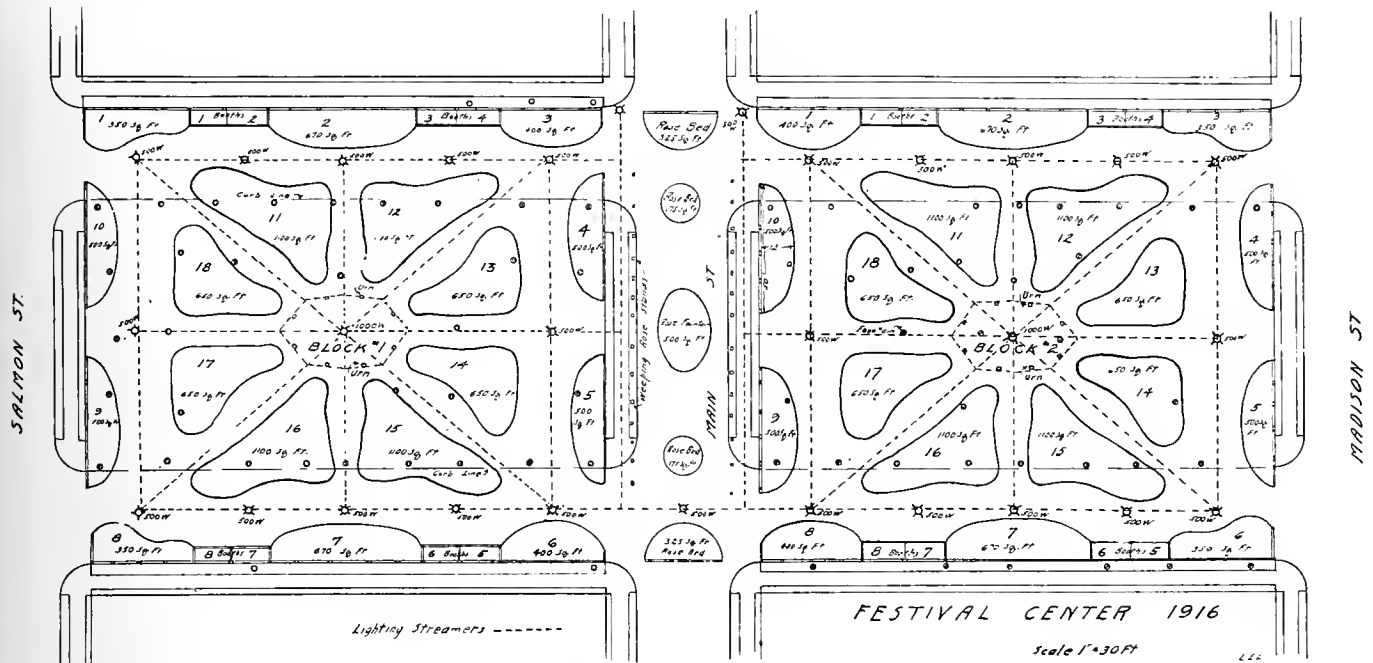
The bridges across the Willamette River were illuminated as were also two warships in the river.

In decorating the park blocks between Madison and Clay streets the following material was used:

Two type "C" lighting units with 1000 watt lamps, twenty-seven type "C" lighting units with 500 watt lamps, approximately 3700 ft. of lighting streamers with lamps. Approximately two hundred Japanese lanterns. The necessary messenger cables to support the lighting streamers and type "C" lighting units properly. The feeders for connecting from the transformers to the lighting system. Transformers were located on poles at convenient places for attachment of the feeder system. The arrangement is shown by accompanying cuts which are self explanatory.

The electrical installation in the festival center blocks, included between Salmon and Madison streets, were handled under a separate contract and provided feeders, overhead streamers, special lighting units, and wiring of the floral booths as shown in accompanying cut. The specifications for the rose fountain were as follows:

"The rose fountain is composed of a fountain head from which the water issues, a shaft or tower down which the water flows, a basin which receives the water and a basin rim which retains the water, within the basin. It is primarily intended to represent a fountain of roses bubbling over in a foaming spray at the top and falling in sparkling sheets into the basin at the foot of the fountain, where it splashes and swirls about in numerous eddies. Trailing rose vines and rose blooms will carry out this effect, but the movement, sparkle and foam must be produced by electric lights in connection with a suitable flasher. The contractor must keep in mind, during his estimating (and if the successful bidder, during his construction work), the fact that roses are the primary feature of the fountain and the electric lights are only the secondary feature. While the electrical features are equally as important in the success of the fountain as the floral features, yet they must be carried out in such a way that the movement and sparkle will appear to be that of the roses themselves. In fact, this feature is of so much importance that unless the committee can assure themselves that the



Map of Festival Center.

bidder is capable of and will make every effort toward carrying out their desires in these respects as just explained, it will be necessary for them to refuse to consider the bid. In other words, the bidder on this portion of the work must furnish ample evidence of his ability to successfully perform the work in case the contract shall be awarded to him.

"The fountain head shall consist of the top part of the fountain, approximately five feet in height, from which the water apparently issues and passes down over the sides of the tower or body. It is to be constructed as a separate piece and in such a manner that it may be set upon and securely attached to the top of the tower frame. It is to consist of electric lights not over six inches apart arranged in strips in such a manner as to form a central jet with two or three spurts of light higher than the main jet and a little lower than the rounded head of the fountain, representing the main body of water boiling over and falling down the sides of the fountain. The strips of lamps forming this head are to droop far enough to mingle freely with the strips forming the fountain tower or body. Great care must be taken to make the supports of these lighting strips as inconspicuous as possible. A coat of neutral paint will assist materially in this respect and must be used.

"The fountain tower is to be 30 ft. high. The frame work will be approximately three feet in diameter at the top and at the bottom will form an oval 8 ft. by 10 ft. This frame work will be constructed by the festival center committee and will be ready for the contractor in ample time to permit him to fulfill the requirements called for in this specification. The frame will support the shelves on which will be placed the pots containing the trailing rose vines that are to form the rose fountain. The strips of lamps which are to carry out the effect of the water falling down the sides of the tower may be attached to this framework and allowed to fall downward and outward as shown in the cross-section of the tower in one of the cuts accompanying this article. The rose vines are to fall over the outside of the lighting strips and partially conceal them. The strips supporting the lamps must be painted green of a shade to match the rose leaves. The shade to be used must meet the approval of the engineer, and the contractor must secure this approval before painting the strips. Sixteen of these lighting strips are to fall continuously from the top of the tower into the basin, and approximately 12 ft. above the ground up the sides of the tower, sixteen other strips arranged alternately with

the longer ones are also to fall continuously into the basin. This arrangement of strips is shown clearly in the developed cut showing the sides of the tower. The lamp spacing of



Day Picture of Electrical Rose Fountain.

these strips will be approximately nine inches except for the two top lamps on each of the short strips, in which case the spacing will be approximately twelve inches.

"The fountain basin is elliptical in form, 20 ft. by 30 ft. outside of the rim, the long diameter, as also that of the fountain tower, coinciding with the longitudinal center line of the

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

SEASONAL USE OF WATER IN THE SACRAMENTO AND SAN JOAQUIN VALLEYS.

The run-off of the streams of the Sacramento and San Joaquin Valleys of California decreases during July, so that without storage many canal systems have difficulty in securing the amounts of water required during the later part of the season. This is particularly true on those streams where the development is relatively large in proportion to the stream flow. On some systems storage works have been constructed; on others, plans for their use have been made, actual construction being delayed until the area irrigated increases beyond the capacity of the normal low flow.

For many systems the seasonal distribution of water, or seasonal duty, depends more largely on the water available than on actual crop needs. Systems where the late summer flow is deficient may either attempt to raise the water table by excessive use during the early summer—a form of ground storage,—so that crops may be supplied from this source, or the crops may be adapted to the character of the water supply. Systems having a late season water supply available or individuals securing their water by pumping are more independent in their choice of crops and time of application.

In attempting to find out the need for late season water, two methods of comparison may be used. The seasonal use of gravity systems having available full seasonal supplies may be compared with those where the late supply is deficient, or the difference in yield due to different practice in irrigation may be compared to give an indication of the crop value of late irrigation. The following discussion includes comparisons of both of these two types. They were mainly prepared from the records of use and of experiments which are published in Bulletin No. 1 of the California Department of Engineering.

In Fig. 1 and Table 1, the seasonal use of different canal systems is given. These are expressed in the percentage of the total annual diversions which occur in each month. Of the four years for which records are shown, two (1912 and 1913) were years of less than normal rainfall and of late season water supply, and two (1914 and 1915) were years of more than normal precipitation. In 1915, the spring was unusually late and wet, use in the earlier season months being much less than normal.

On the Orland project the storage was not fully developed in 1912 and 1913, and the use, after early

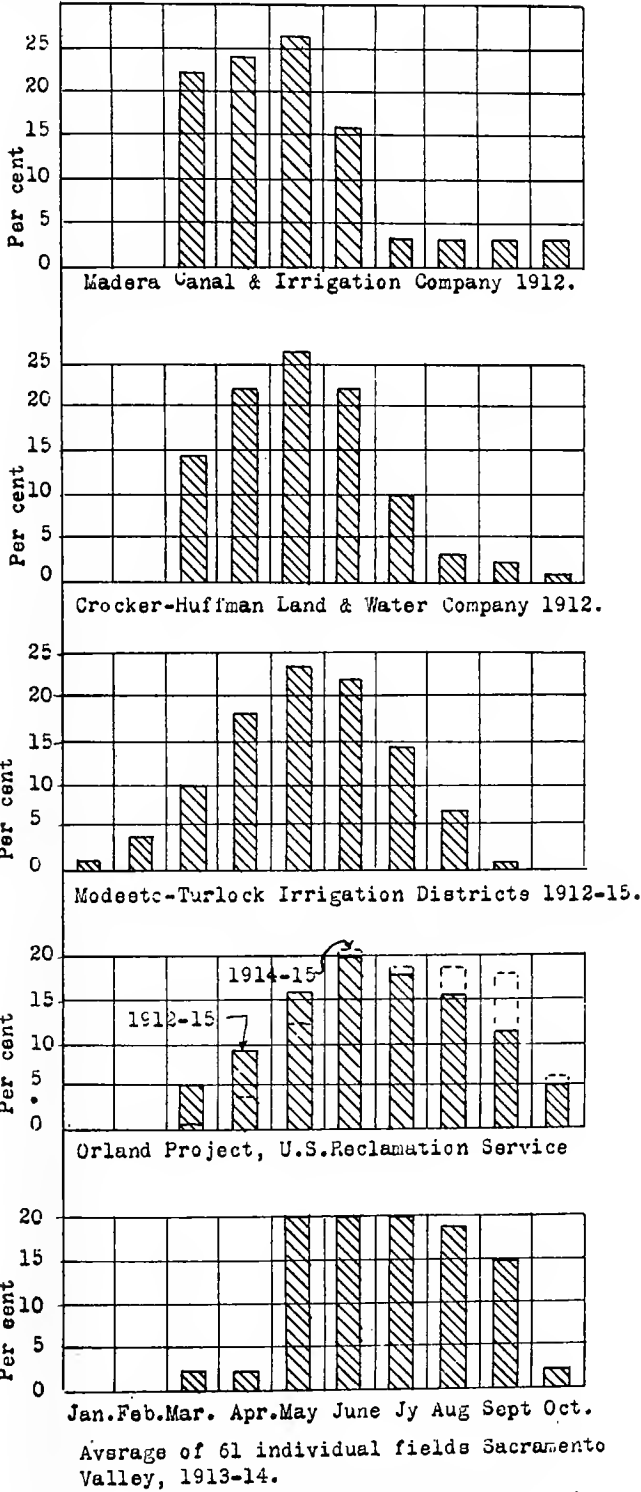


Fig. 1. Per Cent of Total Seasonal Supply Used in Each Month by Different Systems.

Table 1.—Per Cent of Total Seasonal Supply Used in Each Month by Different Systems.

Canal.	Year.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Madera Canal and Irrigation Company.....	1912	..	..	22	24	26	16	3	3	3	3	..	..
Crocker-Huffman L. & W. Co.....	1912	..	..	14	22	26	22	10	3	2	1	..	..
San Joaquin & Kings River Canal.....	1912	5	5	11	15	18	19	17	7	3	..	..	..
Modesto Irrigation District.....	1912	..	4	13	20	27	21	14	1	..	..	..	..
Modesto Irrigation District.....	1913	7	6	9	21	21	21	11	3	1	..	..	..
Modesto Irrigation District.....	1914	4	8	12	11	17	19	17	11	1	..	..	..
Modesto Irrigation District.....	1915	..	2	15	16	20	22	20	4	1	..	..	..
Turlock Irrigation District.....	1912	..	4	13	16	24	25	16	2	..	..	..	..
Turlock Irrigation District.....	1913	..	7	10	19	23	22	13	6	..	..	..	..
Turlock Irrigation District.....	1914	..	..	7	24	34	26	0	6	3	..	..	..
Turlock Irrigation District.....	1915	..	..	2	14	14	21	21	24	4	..	..	..
Mean Modesto-Turlock	1912	1	4	10	18	23	22	14	7	1	..	..	..
Orland Project.....	1912	..	..	3	11	19	19	17	15	8	8	..	..
Orland Project.....	1913	..	..	16	19	22	17	17	9	..	..	..	..
Orland Project.....	1914	..	..	2	7	18	18	16	18	16	5	..	..
Orland Project.....	1915	..	..	..	6	24	22	20	20	20	8	..	..
Orland Project.....	1915	..	..	..	9	16	20	18	16	11	5	..	..
61 Individual Fields.....	Mean	..	..	5	9	16	20	18	16	11	5	..	..
1913-14	..	..	..	2	2	20	20	20	19	15	2	..	..

in August, particularly in 1913, represents less than would have been used could additional water have been secured. In 1914 and 1915 sufficient water was available so that the use represents practice under conditions of ample water supply. The increased use after July in 1914-15 in comparison with 1912 and 1913 is very noticeable.

The Modesto and Turlock systems both divert from Tuolumne River. It is usual for these two canals to take all the available flow in the Tuolumne River after early in July. The use in August and September represents what can be secured, rather than the amount which would be used if a more complete supply were available. The figures for the different years vary, due to the difference in character of the season, and run-off. The zero use by the Turlock system in July, 1914, was due to a break in the canal during that month.

The records for 1912 on the Madera, Crocker-Huffman and San Joaquin and King's River canals are representative of the water supply of the stream from which they divert. The Madera canal diverts from Fresno River, whose flow is derived from lower drainage areas of light snowfall. The supply after June is uncertain and the use in these months necessarily small. The Crocker-Huffman canal diverts from the Merced River. The difference in the July use between this canal and the Modesto and Turlock canals in 1912 is due to the difference in available flow in the streams. The San Joaquin and King's River canal diverts from the San Joaquin River, and in 1912 was able to secure a greater proportion of its supply in July and August than the other San Joaquin Valley systems cited.

In the Bulletin 1 previously cited, the seasonal use of water on a large number of alfalfa fields in different parts of the Sacramento Valley is given for 1913 and 1914. Excluding those around Woodland, where the use is irregular, the average for the remaining 61 fields is also given in Table 1. This shows an even larger use of water in August and September than that on the Orland project. These fields were in locations where late season water could generally be secured.

These various records are for systems on which alfalfa is the principal crop. The lands are similar in season and other factors affecting the time of use. The results on the Orland project in 1914 and 1915 and on the individual fields show an average use in August of 19 per cent, in September of 16 per cent, and in October of 4 per cent of the total season's use. This may be taken as representative of the proportion of the total amount which will be used if available during these months. It would appear that systems having a large proportion of their area in alfalfa will use one-third of the total season's supply after August 1. This

cannot be done at present on streams extensively developed unless storage is available. The need of this later season use is becoming felt on several systems, and plans for storage are under way. The ability to secure such water for irrigation throughout the season is also one of the advantages of supplies pumped from wells. It may not be desirable to provide one-third of the total supply after August 1, but some amount greater than the average of 8 per cent secured by the Modesto and Turlock systems is needed. In many years, systems depending on direct flow also find difficulty in securing a full supply in July.

The expense which will be warranted for storage or other means of securing an adequate water supply for the later season depends on the increase in yield which can be secured for its use. Such increase can be most easily measured for alfalfa, due to the number of crops secured during the season. The value of such water supplies may be greater for other crops which may need late irrigation.

The later cuttings of alfalfa are usually of less weight than those secured earlier in the season, so that a late summer irrigation on this crop will not add as much to the yield of the crop as one applied in the early summer. Late summer irrigation is not required for grain. It is not usual, however, to irrigate much grain in this section of California. Land from which grain has been harvested may, however, be irrigated and a crop of Egyptian corn secured in the same year if a water supply is available. For deciduous fruits the time of irrigation varies with the variety of fruit. Irrigation after picking is practiced in some localities for some early season fruits, such as apricots. Except where supplied by sub-irrigation, later seasonal use of water is usually needed for deciduous fruits.

It is difficult to measure the additional yield produced by late irrigation for any crop except alfalfa. The yield of fruit depends on many other factors besides irrigation and the practice of one year may affect the following year's crop. In connection with experiments on the duty of water for alfalfa on the University Farm at Davis, different amounts and times of application were tried on different plats from 1910 to 1914. From these results the following data are taken, being rearranged from the tables published in Bulletin 1 of the California Department of Engineering and Bulletin 10 of the U. S. Department of Agriculture. The comparisons as to returns were based on an estimated labor cost of production of \$2.25 per ton. The cost of water was taken at \$1.70 per acre foot, the cost at Davis, and the labor cost of applying water at 50 cents per acre per irrigation. The value of hay in the stack for the five years varied from \$4 to \$10 per ton averaging \$7.28 per ton.

Table 2.—Comparisons of Water Used, Yield and Returns in Alfalfa Experiments, Davis, Cal., 1910-14.

Total Depth of Water Applied per Season in Inches.	Schedule of Irrigations in Reference to Cuttings	Yield in tons per Acre	Total Value of Crop per Acre	Increase in Yield Over that Secured with		Increase in Net Returns Per Acre Over That Secured with		Increase in Returns per Acre Foot of Water Used Over that Secured with	
				Two 6 in. Irrigations Tons per Ac.	Three 6 in. Irrigations Tons per Ac.	Two 6 in. Irriga- tions.	Three 6 in. Irriga- tions.	Two Irriga- tions.	Three Irriga- tions.
0	.....	4.42	\$32.41	.....	.....	.....	.....	.....	.....
12	6 in. after 1st and 2d.....	5.90	42.63	.....	.....	.....	.....	.....	.....
18	6 in. after 1st, 2d and 3d.....	7.04	51.29	1.14	.....	\$ 5.58	.....	\$11.16	.....
24	6 in. after 1st, 2d, 3d and 4th.....	7.81	55.81	1.89	.77	7.90	\$2.32	7.90	\$4.64
30	7½ in. after 1st, 2d, 3d and 4th.....	9.12	65.75	3.22	2.08	14.87	9.29	9.91	9.29
36	9 in. after 1st, 2d, 3d and 4th.....	9.40	66.98	3.50	2.36	15.47	9.89	7.74	6.60
48	12 in. after 1st, 2d, 3d and 4th.....	9.43	68.20	3.53	2.39	16.62	11.04	5.54	4.42
60	12 in. after 1st, 2d, 3d 4th and 5th..	9.19	67.57	3.29	2.15	16.03	10.45	4.01	2.98

These experiments were conducted on a dark-brown loam of good water-holding capacity. Ground water averaged 14 ft. below the surface. The average yield obtained with no irrigation, 4.4 tons, indicates favorable conditions for growth without irrigation.

Different schedules of irrigation were used. The plats on which 1, 2, 3, or 4 irrigations of 6 inches' depth each were used give the best comparisons as to the effect of late season water. The other schedules on which greater depths of single irrigation were used are not as directly comparable.

The comparisons show that where an irrigation was applied after the third cutting it increased the yield $\frac{3}{4}$ of a ton over that on those plats receiving only two irrigations. Deducting the cost of irrigation and handling this increase in yield, an additional return of \$5.58 per acre per year was secured. Where a fourth irrigation was given, the increased return over two irrigations was \$7.90 per acre and over three irrigations \$2.32 per acre. As six-inch depths of irrigation were used, this amounts to an increased return for each acre-foot used on the land of \$11.16 where three irrigations are compared with two irrigations, and of \$4.64 where four irrigations are compared with three. It should be remembered that these numerical comparisons are for the conditions at Davis. Where the water table is raised by early irrigation, late irrigations may be of less benefit. Where the soils are porous without ground water within reach of the crop, the yields secured without irrigation or with only two irrigations would be correspondingly less and the benefits from late irrigations correspondingly greater. For heavy soils more frequent irrigations are often necessary, due to the small amount of water which is absorbed by the soil at each irrigation.

Other crops were included in these experiments. The grain irrigation was completed in May. In one experiment with Egyptian corn, three irrigations, one each in June, July, and August, gave an increase in yield of 1275 pounds per acre over that secured from one irrigation in June and an increase of 315 pounds over that secured from two irrigations, one each in June and in July. In two experiments with sugar beets, two irrigations gave greater yields than one irrigation, and in one experiment these irrigations gave an increase in yield of 3.85 tons over two irrigations. The irrigation of the beets, however, was completed by the middle of July and could have been supplied by most gravity systems without storage.

These comparisons of seasonal duty and yield under varying irrigation practice give some indication of the need and value of irrigation after July in these valleys. The present seasonal use of water is determined for many systems by the nature of the water supply and the crops and their irrigation practice adapted to the nature of the water supply. If late season water can be secured either by pumping from ground water or by storage, the choice of crops need not be limited by the seasonal supply available. As development becomes greater in proportion to the normal flow of the different streams storage will become more necessary, and increased use of stored water is to be expected.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.

Discussion of Projects.

I shall herein discuss only, and in briefest terms, certain features of those projects which it seems to me specially call for consideration beyond the information and data given in Fig. 40 for all the projects. I shall also discuss briefly some of those areas and projects which for various reasons were not regarded as probable users of Celilo power.

Castle Rock Slope.—This is the largest and most important irrigation pumping project in Oregon, embracing a possible irrigable area of 150,000 acres, the general boundaries of which may be defined as follows: On the west it is bounded by Willow Creek, on the north by the Columbia River and by the southerly limit of the West Umatilla Project, on the east by the Umatilla River, Hunt's Canal and Butter Creek, and on the south by the higher lands, for which pumpage is not regarded as feasible.

Its soils may generally be described as being a volcanic sandy loam of a general depth of from one to ten feet. Along the Columbia River and at westerly end of project a strip two miles wide by ten miles long may be classed as "scab land," i.e. lands with rock exposed at its surface, and practically all of this area has been eliminated as non-irrigable. The soil is by no means uniform over the project, volcanic loam prevailing in the westerly half of project, while the easterly half ranges from sandy loam to gravelly loam, the more gravelly portion being at the extreme easterly end of the project.

The district contains excellent lands to an elevation of at least 750 ft., but it is not deemed feasible to reach this elevation, and the elevation of the highest land considered is only 685 ft., which however, means an actual pumpage head, including friction losses, of 457 ft. and a mean pumpage head of 381 ft. An auxiliary pumping scheme has also been considered which contemplates a maximum lift of only 310 ft. The gross area included in the larger project is 172,000 acres, of which 150,000 acres are classed as irrigable, and in the smaller project 62,000 acres, of which 50,000 acres are classed as irrigable.

A possibility for storage exists on this project, this being in the so-called Carty reservoir site, with dam site located in section 33, township, 3 north, range 24 east. It appears that with an earth dam 55 ft. high, about 30,000 acre feet of effective storage might be secured at a cost of about \$6 per acre foot. The utilization of such storage would permit a certain amount of winter pumpage which might operate to slightly reduce the total per acre cost of project, though this is by no means certain, nor have sufficient borings been made to definitely establish the water tightness and general merit of the reservoir. For these reasons and for the reasons mentioned in a previous paragraph concerning storage no allowance was made for storage in estimating project costs.

The project costs have been worked out on a basis of installing concrete pump houses equipped with high grade machinery throughout and of main canals and distribution system down to carrying capacities

of 5 s.f. being lined with concrete except where fluming or piping may be necessary. The cost estimates, omitting details, were as follows:

Item.	150,000 acre Project.	50,000 acre Project.
Main pumping station.....	\$1,332,000	\$ 443,000
First auxiliary pumping station.....	75,000	
Second auxiliary pumping station.....	366,000	
Pressure mains	1,500,000	315,000
Main canals and distribution system..	4,300,000	1,400,000
Engineering and contingencies.....	1,635,000	432,000
Total	\$9,809,000	\$2,590,000
Cost per acre	\$65.40	\$51.80

It is possible to serve all of the larger area by a gravity supply from the John Day River and nearly all of the smaller area by a gravity supply contemplating storage on the Umatilla River, though it is certain that both of these projects will be of high initial cost. An investigation and report made by the writer in 1909 indicated a cost of \$109 per acre for the John Day development and recent estimates for the Umatilla development indicate a cost of \$90 per acre. The proposed pumping schemes, however, must be compared with these possible gravity schemes which latter, despite their high initial cost, may prove the more economical. Until all these alternatives have been developed from careful surveys no final selection of character or size of project is possible. My present opinion, however, is that the pumping schemes will be about on a parity with the gravity schemes, as to ultimate economy, for practically any lift herein considered and in view of their advantage in the matter of requiring a far less initial investment I think they should by all means be included as a possible future demand on Celilo power.

Horse Heaven Slope.—This contemplates the irrigation of 61,000 acres lying on the Washington side of the Columbia River immediately opposite the Castle Rock slope in Oregon. It contemplates a maximum lift of 394 ft. and a mean lift of 300 ft. from a single pumping station located just east of Plymouth, in Sec. 4, T. 5 N., R. 28 E., W. M. There is another feasible pumping station site at Carley, at the extreme western end of the project in Sec. 12, T. 4 N., R. 23 E.

If two pumping stations were utilized, the Carley station would serve some 24,000 acres west of Glade Creek and the Plymouth station about 44,000 acres east of Glade Creek, thus embracing a total of about 68,000 acres as against the 61,000 acres contemplated from the single pumping plant at Plymouth. The Carley plant would require about 30 ft. greater lift than the Plymouth plant, and the economy of the two plant arrangement would depend upon the amount that might be saved by reason of the reduced capacities of the main canals, a matter which I have not yet gone into.

There exists some storage possibilities on this project, the reservoir damsites being located in Sec. 21, T. 5 N., R. 24 E.; Sec. 18, T. 5 N., R. 25 E.; and Sec. 21, T. 5 N., R. 25 E. All of these reservoir sites embrace good irrigable lands, and for reasons hereinbefore given storage was not figured on in the preliminary consideration of the project.

The cost estimate for this project, omitting details, is made up as follows:

Pumping station complete.....	\$ 475,000
Pressure mains	80,000
Main canals and distributing system.....	2,565,000
Engineering and contingencies.....	624,000
Total	\$3,744,000
Cost per acre for 61,000 irrigable acres.....	\$61.38

(To be continued.)

LETTER TO THE EDITOR.

Irrigation Department.

Sir:—I have read with a great deal of interest the announcement in the Journal of the 1st instant, concerning the Irrigation Department, and the article by Professor S. T. Harding who is to have charge of this Department of the Journal. I feel very much pleased myself that you have decided to add this department to the Journal, as I believe it will prove of considerable value to the electrical industry, and will make your journal even more popular than it now is. I would like very much indeed to give this matter considerable personal attention, if you consider it advisable, and to that end shall be glad to advise with Professor Harding at his pleasure.

As you are fully aware the possibilities for the further use of electric energy in the agricultural industry are very extensive. In fact, I feel that we have really just begun to intelligently work in this field. Most of the central stations operating in the Western states already have extensive distributing systems and are so situated that a great deal of additional load in the agricultural communities can be added with a very little increase in investment. This applies particularly to what might be termed the domestic uses of electricity.

Yours very truly, S. M. WALTON,
Manager Commercial Dept., Pacific Gas & Elec. Co.

GRANDVIEW BIDS.

Bids for the power and pumping equipment of the Grandview Irrigation District, Sunnyside Unit, Yakima Project, Wash., have been received at Denver, Colo., as follows:

Schedule 1—Electrical Apparatus.

Name of Bidder.	Item 1. Gen. & ex. Equip.	Item 2. 3-60 k.v.a. Single-phase Transformers.	Item 3. Switch- board Equip- ment.	Combina- tion Bid for all Apparatus in Schedule 1
General Elec. Co., Schenectady, N. Y.	\$5,442	\$1,472	\$3,420	\$12,190
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.	2,900	1,230	3,000	1,130
Fairbanks, Morse Co., Denver, Colo.	....	1,482	....	....
Pittsburgh Transformer Co., Pittsburgh, Pa.	....	1,152	....	....

Schedule 2—Hydraulic Apparatus.

Name of Bidder.	Item 1. Direct Hydraulic Turbine 270 hp., 600 r.p.m. 73 ft. Head.	Item 2. Pumping Unit Using 110 Sec. ft. at 21 ft. Head. Pumping 78 ft. Head.	Item 3. 10 Sec. ft. 78 Ft. Lift Pump and Motor.	Item 4. 10 Sec. ft. 35 Ft. Lift Pump and Motor.	Item 5. 10 Ton Hand Power Traveling Crane
S. Morgan Smith Co., York, Pa.	\$4,500	\$8,300	....	....	....
The Trump Manufacturing Co., Springfield, Ohio.	3,250	....	....	....	....
Pelton Water Wheel Co.	4,865	....	Pump \$1,065	\$1,065	....
Pelton Water Wheel Co.	....	....	G.E. Mot. \$1,088	\$1,096	....
Pelton Water Wheel Co.	....	....	W.H. Mot. \$ 962	\$ 901	....
Pelton Water Wheel Co.	....	....	Tot. G.E. \$2,153	\$2,161	....
Pelton Water Wheel Co.	....	....	Tot. W.H. \$2,027	\$1,997	....
Fairbanks, Morse Co.	....	....	Pump \$ 635	\$ 635	....
Fairbanks, Morse Co.	....	....	Total \$1,880	\$1,745	....
Cyclops Iron Wks., Denver	....	....	....	....	\$ 675
Whiting Frndy. Equip. Co.	....	....	....	....	735
Brown Hoisting Mach. Co.	....	....	....	....	750
Niles-Bement-Pond Co.	....	....	....	....	1,615

Schedule 3—Steel Work, Etc.

Name of Bidder.	Item 1. Riveted Steel Pipes.	Item 2. Cast Iron Head Gates.	Item 3. Trash Racks.	Combina- tion Bid for all Material in Schedule 3.
Western Pipe & Steel Co.	\$2,713	\$ 525	\$ 670	\$3,900
Vulcan Iron Works, Denver.	....	420	....	....
Trump Mfg. Co.	....	....	510	....
Judson Mfg. Co., San Francisco	....	....	397	....

THE ST. PAUL ELECTRIFICATION.

While many railway terminals and tunnel electrifications have been made in the past, the Chicago, Milwaukee & St. Paul electrification is the first where electric locomotives operate over several engine divisions. Four divisions have been electrified, aggregating 440 miles in length, the first being the Three-Forks-Deer Lodge Division, 115 miles long, and crossing the main Continental Divide. The first electric locomotives were placed in regular service on December 9, 1915, and during the month of April, 1916, service was extended to Harlowton, making a total of 220 miles of electrically operated road. By the first of November, 1916, it is expected that steam engines will be superseded over the entire distance of 440 miles from Harlowton, Montana, to Avery, Idaho, the most ex-

The Electrical Equipment.

The scheme of electrification includes the generation of electricity from the several water power plants of the Montana Power Company; transmission at 100,000 volts, three-phase, 60 cycles; conversion in substations to 3000 volts direct current and distribution over catenary overhead construction, to electric locomotives. The main line locomotives are constructed in two units permanently coupled together, the halves being duplicates and each capable of independent operation. They are the first to be used for railroad service with direct current motors operating at a potential as high as 3000 volts and the first to use direct current regeneration. The 30 passenger locomotives are equipped with a gear ratio permitting the operation of 800 ton trailing trains at



"Olympian" Entering the Montana Canyon.

tensive steam railway electrification in the world.

In crossing the three mountain ranges included in the electric zone, there are several grades of one per cent or more, the most difficult of which is the 21 mile two per cent grade between Piedmont and Donald, and the longest the 49 mile one per cent grade on the west slope of the Belt Mountains. The curvature is necessarily heavy, the maximum being 10 degrees. There are also numerous tunnels in the electric zone, 36 in all, of which the longest is the St. Paul Pass tunnel, over a mile and a half in length, through the ridge of the Bitter Root Mountains.

The passenger service consists of two all-steel finely equipped transcontinental trains in each direction, the "Olympian" and "Columbian," and a local passenger train in each direction daily between Deer Lodge and Harlowton.

Freight traffic through the electric zone comprises from four to six trains daily in each direction. West-bound, the tonnage is made up of manufactured products and merchandise for Pacific Coast points and foreign shipments. Eastbound tonnage includes grain, lumber, products of the mines and some live stock.

speeds of approximately 60 miles per hour on tangent level track. The average passenger train weighs from 650 to 700 tons and is hauled over the two per cent grade without a helper. The 12 freight locomotives are designed to haul a 2500 ton trailing train at approximately 16 miles per hour on all grades up to and including one per cent. On two per cent grades the trailing load was limited to 1250 tons, although this figure has been exceeded in actual operation.

Each locomotive is equipped with eight Type General Electric 253-A, 1500 volt motors, insulated for 3000 volts to ground. This motor has a normal one hour rating of 430 h.p. and a continuous rating of 375 h.p., so that the locomotive power plant has a normal one hour rating of 3440 h.p. and a continuous rating of 3000 h.p. Each motor is twin geared to its driving axle in the same manner as on the Butte, Anaconda & Pacific, the Detroit River Tunnel, and the Baltimore & Ohio locomotives, a pinion being mounted on each end of the armature shaft. Additional flexibility is obtained by the use of a spring gear and a spring nose suspension which minimize the effect of all shocks and also reduce gear wear to a minimum. The motor

is of the commutating-pole type and is constructed with longitudinal ventilating ducts in the armature for forced ventilation from a blower in the cab.

The control equipment is the Sprague General Electric Type M arranged for multiple unit operation. The main control switches are mounted in steel compartments inside the locomotive cab with convenient aisles for inspection and repairs. A motor generator set in each half of the locomotive furnishes low voltage current for the control circuits, headlights, cab lighting and for charging the storage batteries on the passenger coaches. Under steam operation, the charging current for these batteries is furnished by a steam turbo-generator set located on the locomotive. The blower for ventilating the traction motors is also direct connected to one end of this set.

The pantograph collectors, one of which is mounted on each half of the locomotive, are of the double pan type with a working range of from 17 ft. to 25 ft. above the rail. The contact elements are of the same metal as the trolley wire, so that current passes from copper to copper.

The air brake equipment is practically the same as that used on steam locomotives except that motor driven air compressors are used to furnish compressed air. Aside from the air brakes, compressed air is also used for signals, whistles, bell-ringers, sanders, flange oilers, pantograph trolleys, part of the control equipment, and on the passenger locomotives for the oil-fired steam boilers.

The switching locomotives are of the swivel truck type, weighing 70 tons each, and equipped with four geared motors. A single pantograph of construction similar to that used on the main line locomotives is mounted on the cab and in other ways the locomotives represent the standard construction commonly used with the steeple cab type of switcher. The motors (known as Type GE-255) are of box frame, commutating-pole, single-geared type designed for 1500 volts with an insulation of 3000 volts to the ground. Many of the switching locomotive parts are interchangeable with those used on the main line locomotives; for example, the air compressors, small switches, headlights and cab heaters.

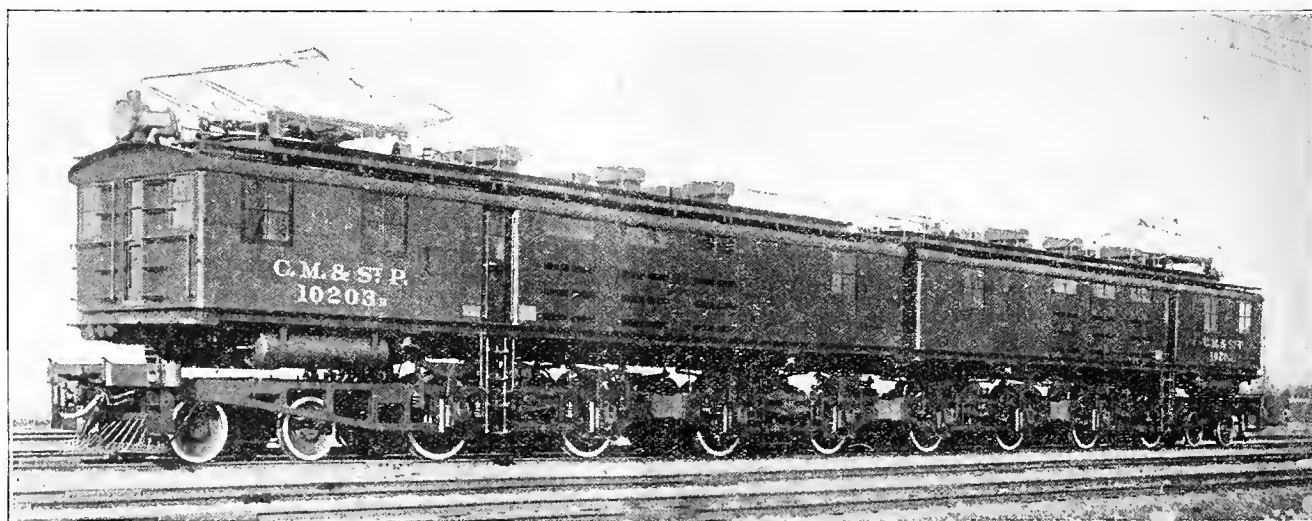
The Montana Power Company's transmission lines, which are carried in some cases on steel towers

and in others on wooden poles, tap into the railway system at seven different points where the power is most needed. The railway company's transmission line extends the entire length of the system on wood poles. In most cases this line is built on the company's right-of-way, although at several points there are cutoffs which make a considerable saving in the length of line.

The water power plants are so located at widely separated points that there is little probability of an interruption of the supply. Available capacity of storage reservoirs in service is 447,150 acre feet, of which the largest, the Hebgen reservoir on Madison River, contributes 325,000 acre feet. There is a further undeveloped capacity of 78,500 acre feet.

The standard transmission pole consists of 45 and 50 ft. wood poles with two cross arms carrying 100,000 volt lines on suspension type insulators and also an un-insulated ground wire. There are a number of modifications of this construction on curves, at corner points, substation entrances, etc.

Completed Hydroelectric Plants.		Installed Capacity kw.
Great Falls, on Missouri River.....		60,000
Rainbow Falls, on Missouri River near Great Falls, completed in 1910.....		27,000
Black Eagle Falls, on Missouri River near Great Falls, reconstructed in 1913.....		3,000
Black Eagle Falls, hydraulic power, 8,000 h.p.		
Hauser Lake, on Missouri River, northeast of Helena, completed in 1911.....		18,000
Canyon Ferry, on Missouri River, northeast of Helena, completed in 1898 and enlarged in 1901.....		7,500
Madison No. 1, on Madison River, 60 miles southeast of Butte, completed in 1901 and remodelled in 1907....		2,000
Madison No. 2, on Madison River, 60 miles southeast of Butte, completed in 1906.....		10,000
Big Hole, on Big Hole River, 22 miles southwest of Butte, completed in 1898.....		3,000
Livingston, on Yellowstone River, completed in 1906 and enlarged in 1908.....		1,500
Billings No. 1, Yellowstone River, completed in 1907....		1,080
Lewiston, on Spring Creek, completed in 1906 and remodelled in 1913.....		450
Thompson Falls, on Clark's Fork of Columbia River....		20,000
		153,530
Steam Plants.		
Butte, completed in 1907.....	5,000	
Billings, completed in 1906.....	560	
Conrad, completed in 1910.....	110	
Phoenix, in Butte, completed in 1895.....	250	
		5,920
Total		159,450
Hydroelectric Powers in Course of Development and Definitely Projected.		Capacity kw.
Thompson's Falls, on Clark's Fork of Columbia River, additional units to be installed in 1917.....		10,000
Holter, on Missouri River near Helena, under construction, to be completed in 1917.....		40,000
Total		50,000



Electric Locomotives of the Chicago, Milwaukee & St. Paul R. R.

Hydroelectric Power Sites Undeveloped.

Site "C" at Great Falls, on Missouri River, between Rain-bow and Great Falls	28,500
Below Great Falls, on Missouri River	28,500
On Missouri River about 30 miles northwest of Missoula	13,500
Madison No. 3, on Madison River	18,500
Black Eagle Plant, reconstruction	10,000
SNAKE River Falls, on Henry's Fork of Snake River, 20 miles north of St. Anthony, Idaho	22,500
Total	121,500

Summary.

Completed hydroelectric and steam plants	159,450
Hydroelectric powers in course of development	50,000
Hydroelectric power sites undeveloped	121,500
Total	330,950

Summary of Transmission Lines in Service January 1, 1916.

	Miles.
Steel tower lines, 100,000 volts	305
Steel tower lines, 50,000 volts	35
Pole lines, pin type, 11,000 to 60,000 volts	635
Pole lines, suspension insulator type, 50,000 to 100,000	512
Bridge type, 100,000 volts	341
Total	1,828

With this completely inter-connected transmission system, each substation may be fed from either direction and also at the tie-in points from a third source of power.

Fourteen substations are equipped for converting the 100,000 volt alternating current to 3000 volts direct current. They are distributed along the route at average intervals of 32 miles. Each station contains step-down transformers, motor generator sets, switchboard and the necessary controlling and switching equipment. The transformers receive the line current at 100,000 volts and supply the synchronous motors at 2300 volts. Each synchronous motor drives two 1500 volt, direct current generators connected permanently in series, thus supplying 300 volt current for the locomotives. The fields of both the synchronous motors and the direct current generators are separately excited by small direct current generators direct connected to each end of the motor generator shafts.

The overhead construction is of the modified flexible catenary type designed by the General Electric Company and installed under the direction of the railway company's engineers. With this quite novel but remarkably successful construction, the current is collected in both high speed passenger service and heavy freight service without any sparking. As may be seen from the illustrations, the construction comprises two 4/0 copper wires flexibly suspended side by side from the same steel messenger by independent hangers alternately connected to each wire. Bracket construction is used wherever the track alignment will permit, and cross span construction on passing tracks and in the switching yards. All of this work is supported on 40 ft. wooden poles suitably guyed and spaced.

Electrical Operation.

Electrification promises a material reduction in running time. It has been found, for example, that on the 21 mile two per cent grade from Piedmont to Donald, the electric locomotive can reduce the running time of passenger trains from an hour and five minutes to approximately 40 minutes. On the run from Deer Lodge to Butte which, under the steam locomotive schedule, required an hour and 20 minutes, a saving of approximately 30 minutes can be made.

In the freight service, it has been found that on the first division where the steam locomotives have required 10 to 12 hours to make 115 miles, electric locomotives can meet a schedule of from seven to eight hours for the same distance. The heavy grades

and frequent curves at certain points offer serious obstacles to steam locomotive operation even in the summer time, but with winter temperatures as low as 40 deg. F. and heavy snowfalls in the Bitter Root Mountains, serious delays have occurred, owing to engine failures or to inability to make steam. The capabilities of the electric locomotives are in no way impaired by cold weather or by inability to obtain fuel or water in case of snow blockades. During a series of record-breaking temperatures in December, 1915, Mallet engines were frozen up at different points on the system and the new electric equipment was rapidly pressed into service to replace them. On several occasions electric locomotives hauled in disabled steam engines and trains which would otherwise have tied up the line.

During initial operation on the Rocky Mountain Division, the capacity of the new locomotives has been thoroughly tested. Trains of 3000 tons trailing have been hauled east and 2800 tons west, using a helper on the heavy grades. From the operating data obtained on the first division, it is evident that much heavier trains can be hauled with the electric locomotives than with steam engines, and all passing tracks are being lengthened to take advantage of longer trains. On some of the runs where the grades are less than one per cent trains of as many as 130 cars and as heavy as 4000 tons have been hauled with a single locomotive.

The four through passenger trains, "Olympian" and "Columbian," are taken across the two mountain ranges by a single passenger locomotive. These trains at present consist of eight full vestibuled steel coaches, weighing approximately 650 tons. Instead of changing locomotives at Three Forks, as has been the practice under steam operation, the same locomotive is run through the 220 miles from Deer Lodge to Harlowton, changing crews midway. Passenger trains will travel over the entire electrified division in approximately 15 hours, including all stops, and the tourist thus will have an opportunity of traversing by daylight some of the most beautiful scenic regions in the United States and without suffering the annoyance of cinders and smoke incident to the use of steam locomotives. The local passenger train operating in the electric zone between Deer Lodge and Harlowton is handled by a half unit weighing about 150 tons with equipment similar to the main line locomotives.

Greater development of water power is urged by the Joint Conference Committee of National Engineering Societies in accordance with the following resolution, copy of which has been transmitted to President Wilson: "The Joint Conference Committee of National Engineering Societies believes that the development of the country's undeveloped water power will increase national prosperity; that private enterprise should be encouraged and stimulated to expedite such development; that unnecessary legal burdens should be removed and existing doubts as to the safety of investment eliminated. It commends to the support of engineers all efforts made to secure the fullest publicity as to the underlying facts regarding this subject."

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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Electrification of Western steam railways is proceeding apace. The Cascade tunnel of the Great Northern Railway, the ore haulage system of the Butte, Anaconda and Pacific and the Rocky Mountain divisions of the Chicago, Milwaukee and St. Paul, together with the rapid extension of interurban railways, presage a new era of railway operation, when the wasteful fuel-locomotive will be superseded by the efficient electric locomotives.

Yet efficiency may be more costly than waste. So for the present and in most localities, at least, electric operation costs more than steam operation. As cost is necessarily the deciding factor, this means a postponement, but not an abandonment, of many plans for railroad electrification.

In some instances new construction would be electric, though it does not pay to electrify old construction. The interest on bonded indebtedness is of greater concern than the cost of current. In one well known case it has been demonstrated that present conditions do not warrant electrification even if current were furnished free of charge. The reason for high interest charges, is, of course, high initial cost. This in turn is largely traceable to lack of standardization of equipment. Each installation is special and consequently costly.

The St. Paul situation warranted immediate electrification. Coal was expensive and hydroelectric power purchasable at a low price. The Butte, Anaconda and Pacific, operating under somewhat similar conditions, had already effected a saving of one-third in the cost of operation. Electrification was the only answer to the problem of cheaper operation.

But this cost consideration is transient. Railroad electrification is inevitable along all main lines in the West. Railroads have anticipated the fact and paper wars between cost and expediency have been played over many times. Here and there cost is lessened, the defense of this opposition is weakened, and expediency wins a battle.

The day is not far distant when all the transcontinental railways will be electrified throughout this Western territory. This will require a great increase in generating capacity and will mark a resumption of activity in hydroelectric construction.

The excellent features of Senator Newland's bill proposing to establish industrial research stations in connection with the land-grant colleges in the several states have been previously explained in these columns. No particularly objectionable features have come to light and the bill would be likely to be passed were it not for the apathy of those who have most to gain from its enactment.

This bill is not a scheme to find jobs for dreamers. Its benefits accrue to land grant colleges only because these solely can legally receive federal appropriations at present. As contrasted with any central laboratory it creates many distributed centers for industrial research and will give local industries better opportunity to enlist scientific aid.

Railway Electrification

Industrial Research

Science is anxious to be of greater service to industry. Industry, on the other hand, does not realize science's past contributions to its welfare and consequently cannot appreciate the value of future aid that would result from more scientific research.

The marvellous electrical developments of today would be impossible without knowledge based on the researches of two scientists working with no apparent thought of the utilitarian value of the application of their discoveries. Faraday discovered the fundamental principles of electro-magnetism, upon which depends the operation of all dynamo electric machines. Maxwell codified Faraday's discoveries into a complete theory to guide all future investigators. Without this fundamental knowledge the inventions of Edison, Bell and Marconi would not have been possible.

Many other examples can be cited,—the development of the dye industry by the Germans, the adapting to commercial liquefaction and separation of gases of Thomson and Joule's theory of temperature reduction through the expansion of a gas in a porous plug, or the improvement in the efficiency of incandescent lamps by investigation of the melting points of metals.

This is the day of organized research. Frequently the individual investigator repines at the futility of trying to compete with the trained staffs of big manufacturing companies with every facility at hand. Under a central administrative office individual research could be conducted effectively and thus would the world benefit from work which individuals hesitate to undertake unaided. Any financial encouragement given the research scientist cannot but ultimately redound to the benefit of humanity.

The latest step in the improvement of American business methods is the proposal to more generally employ trade acceptances as credit instruments. While this system has long been used in England under the name of bills of exchange, it is only with the development of the Federal Reserve banks that the need for it has become acute in the United States. The general purpose was explained by Mr. Russell Lowry, president of the First National Bank of Oakland, California, at a recent meeting of the Pacific Coast Electrical Supply Jobbers' Association, and the subject is also being discussed at meetings of the electrical contractors in Washington, Oregon and California. As the trade acceptance seems to offer a means of improving electrical business conditions, a brief discussion seems to be in order here.

The trade acceptance is a negotiable paper accompanying a bill of lading. When a shipment of goods is received, the purchaser writes the word "accepted" across the face of the paper and signs it, thereby converting it into a bill of exchange discountable at the bank, and consequently convertible into cash. By thus doing away with open accounts or ledger entries, the term of credit is shortened to correspond with the saving in time that has been effected by modern trans-

portation methods. Furthermore, the trade acceptance involves less credit risk, as it carries a triple assurance, that of the maker of the instrument, that of the acceptor, and a definite shipment of goods, whose sale will provide a means of payment.

So it is seen virtually to be a safeguarded promise to pay money and serves as a medium of exchange more flexible than barter or cash and involving less risk and loss of time than the usual open account. Not only is it adaptable to business transactions between manufacturer and jobber and between jobber and retailer, but it also seems applicable to dealings between the retailer and the ultimate consumer.

Private credit has been subject to such abuse that its use is being circumscribed. People seem to forget that credit is merely a deferred payment of money and in the end must be liquidated by the payment of cash. Extravagance ensues and the misuse of credit threatens to counteract its usefulness. Trade acceptances can do much to stop such abuses if they are required from the ultimate consumer. They help to weed out the bilks.

The trade acceptance starts an endless chain. It benefits everybody, from the consumer to the banker and back again to the consumer. Like the house that Jack built, this is the trade acceptance that helps the banker that lends to the manufacturer that credits the jobber that carries the dealer that trusts the purchaser who signs a trade acceptance.

A negotiable contract of this kind not only gives evidence of indebtedness, but also provides an acceptable substitute for money. It is a well-known fact that there is nothing like enough money in the world to transact the world's business. So there is always need for a convenient substitute that banks can accept.

From the banker's standpoint the promissory note and ordinary bank check are of limited acceptancy. With the trade acceptance many of these limitations are eliminated. In addition, it is convertible, perhaps the most essential requisite for banking purposes. Lack of convertibility is the reason that commercial banks are limited in their loans on real estate. So highly do bankers regard this plan that the Federal Reserve banks offer a lower rate of discount on trade acceptances than on single-named commercial paper.

From the dealer's standpoint the trade acceptance increases the frequency of capital turnover, and thus allows greater profits on invested capital. Its general adoption would do much to make electrical contracting a profitable business.

The consumer, also, could be assured that he was not paying for the fellow who does not pay his bills. The high cost of living could be partly reduced by this means.

These manifest advantages of trade acceptances are not generally understood. Education is necessary, particularly as regards the public. Every line of business should participate in bringing about this desirable change in order to make it truly effective; but why cannot the electrical industry be the first to study and adopt this commendable plan, thus lifting themselves out of the financial slough?

PERSONALS

C. C. Hillis of the Electric Appliance Company is making a trip to Tahoe by auto.

Romaine W. Myers, illuminating engineer, has returned to Oakland, Cal., from Spokane.

Ralph Clapp, manufacturers' agent, has returned to Los Angeles, from San Francisco.

F. A. Wood, General Pacific Coast agent of the Gamewell Fire Alarm System is at Los Angeles.

W. S. Berry, sales manager Western Electric Company at San Francisco, is away on his vacation.

F. J. Cram of the Electric Appliance Company has returned from his vacation at Monte Rio.

Geo. K. Tackabury, Honolulu representative of the H. W. Johns-Manville Company, is at San Francisco.

Ed. Duggan, with Holabird-Reynolds Company, has returned to San Francisco from his Yosemite trip.

T. H. Nelms addressed the Kilowatt Club of Oakland, Cal., June 29th on how "Electricity Lessens Housework."

T. W. Simpson, Pacific Coast manager Federal Sign System (Electric) at San Francisco, is away on a vacation.

R. H. Coyne, Pacific Coast manager of the Kellogg Switchboard Supply Company, has returned from Los Angeles.

H. R. Noack of Pierson, Roeding & Company, San Francisco is making an extended vacation trip through the mountains.

Clem Copeland has accepted a position in the electrical engineering department of the Los Angeles Aqueduct Power Bureau.

H. A. Sayles, sales manager of the Holabird-Reynolds Company of San Francisco has returned from a two weeks' vacation.

C. M. Swan, general manager acoustical department of the H. W. Johns-Manville Company of New York, is at San Francisco.

R. D. Holabird, president of the Holabird-Reynolds Company of San Francisco, is at his lodge at Lake Tahoe for two weeks.

A. J. Myers, district agent of Wagner Electric & Manufacturing Company, has returned to San Francisco from a two weeks' visit at Los Angeles.

E. B. Strong, Jr., of the Journal of Electricity, Power & Gas, is with Company D, Fifth Regiment, National Guard of California, as commissary sergeant.

M. K. Turner recently resigned from the sales department of the Pacific Light & Power Company of Los Angeles to join the sales force of Smith-Booth-Usher Company of that city.

S. H. Gould, recently with the Municipal Electrical Department of the City of Shanghai, China, has joined the distribution force of the Pacific Light & Power Company of Los Angeles.

A. A. Smith, of the Berkeley Electric Company, Berkeley, Cal., is taking his vacation in Milwaukee, Wis. **J. Fort**, another member of the firm has just returned from the Yosemite Valley, where he spent his vacation.

John A. Britton, vice-president and general manager Pacific Gas & Electric Company, announces that the salaries of the thirty men in his company who have joined the California troop mobilization will be paid until the first of September, at least.

R. F. Hayward, chief engineer and general manager Western Canada Power Company, has been re-elected chairman of the Vancouver, B. C., section of the American Institute of Electrical Engineers, and **H. N. Keifer**, sales engineer Northern Electric Company, secretary.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The last meeting prior to the summer recess was held on June 28th with a large and enthusiastic attendance. **A. E. Drendell**, as chairman of the preparedness parade committee, reported that a large electrical section would participate. **S. J. Lisberger**, as chairman of the day, then introduced **W. D'Arcy Ryan**, illuminating engineer with the General Electric Company, who gave an interesting talk on "The Development of Illuminating Engineering." After tracing the early history of lighting to the development of the present science of illumination he explained that the latest idea in lighting methods was to obtain artistic effects even at the sacrifice of efficiency—the art of illumination. An interesting feature in this development has been the fact that the original estimate of watts per square foot has been practically constant throughout the period. At first this estimate was too low for effective illumination; then, with greater efficiencies it became correct; later, with still greater efficiencies more light was desired, and finally the desired artistic effect counterbalances the high efficiency of the latest types of lamps. In commenting on the new method of lighting Market street, San Francisco, Mr. Ryan said that it will be the first time that the street will be really seen. He condemned the excess of light as exemplified by the St. Louis scheme and briefly described the proposal to light the retail shopping section of San Francisco.

Los Angeles Jovian Electric League.

The last luncheon of the season, and incidentally, one of the best meetings of the year, was given on June 28th, at Jahnke's Tavern. President **Holland** presided as usual and the program was provided by **Irving R. Solomon**, as chairman of the day. Mr. Solomon represents the Gould Storage Battery Company and aside from his technical and commercial ability, is somewhat of an orator. After a few remarks, he introduced **Chan Kin Sing**, Secretary of the Chinese Chamber of Commerce, who spoke on "China and America." Mr. Chan's talk was unique and interesting. He stated that the Chinese prefer American-made goods and that the Orient represented a potential market for the trades of the world, and



Oregon Electrical Contractors and

that with her population of 420 millions, China presented untold opportunities to the business interests of this country. He was followed by Joe Scott, who roused his hearers to a high pitch of enthusiasm and emotion in an intensely interesting and inspiring address on "America." He was greeted with prolonged applause at the close of his speech. During the business session preceding the talks, it was announced that J. G. Pomeroy had been appointed to represent the League at the Jovian Convention to be held at Indianapolis, in October. Preliminary arrangements for the Rejuvenation to be held on Jovian Day, September 19th, were made and Harry Sessions was appointed chairman of the general committee.

Oregon Electrical Contractors.

The first quarterly convention of the Oregon Association of Electrical Contractors and Dealers was held at Portland, Oregon, on Wednesday, June 28, 1916, the program for the day consisted of meeting out of town members at the office of the secretary during the morning, and at 12:30, all members and their guests met at the Stubbs Electric Company, where a photo was taken, after which all were assigned to automobiles and taken for a drive over the Columbia River Highway as far as Cascade Locks, making stops at nearly all of the places of interest en route. At 5:30 p. m. all assembled at the Crown Point Chalet, the highest point on the highway and at 6 o'clock partook of a banquet furnished by Mrs. Henderson, which has now become famous. During the dinner the Oregon Electric Quartet rendered several fine selections, and the contractors pride themselves upon having the best quartet in the Northwest. They are Ed. Pierce, R. G. Littler, E. L. Knight and Frank Pierce. At 7:30 p. m. the meeting was called to order by President W. O. Foucks who made a report on the progress of the association since its inception, February 9, 1916, and reported that starting with twelve members at that time the association after four months' time had increased its membership to 59 regular and three associate members. Short addresses were given by F. N. Averill of the Fobes Supply Company, upon "Trade Acceptances," Ross Hartley of the Pacific States Electric on "Relations Between the Jobber and the Dealer," J. C. English, "What the Association had Accomplished." Mr. Dickenson of the General Electric Company's Illuminating Engineering Department gave a short history on illuminating appliances, Mr. Colwell of the Western Electric Company addressed the association and complimented them for the fine progress it was making. Messrs. Meecham and NePage of the Washington Association of Electrical Contractors and Dealers were present and each made a fine and interesting talk on association affairs. There were also short talks from John L. Vaughan of Pendleton, Mr. W. H. Welch of Salem, Mr. Chaphe of Tillamook and Mr. Walrath of Forest Grove.

AMERICA'S ELECTRICAL WEEK COMMITTEEMEN.

The following have been named as California Committeemen for "America's Electrical Week," to be conducted by the Society for Electrical Development, December 2-9, 1916:

Fresno—A. G. Wishon, General Manager San Joaquin Light & Power Corporation.

Los Angeles—H. B. Woodhill, general manager Woodhill & Hulse Electric Company; T. E. Burger, manager Western Electric Company; J. O. Case, General Electric Company; J. Harry Pieper, Southern California Edison Company; J. C. Rendler, president Southern California Electric Company; E. R. Davis, general manager Pacific Light & Power Company; K. E. Van Kuran, district manager, Westinghouse Electric & Manufacturing Company; Carl E. Johnson, general manager U. S. Electrical Manufacturing Company; F. H. Trimble, Electric Lighting Supply Company; N. W. Graham, Holabird-Reynolds Electric Company; C. E. Spalding, Edison Lamp Works General Electric Company; H. C. Warden, secretary The Rotary Club; Morris M. Rathbun, Chamber of Commerce.

Oakland—F. H. Woodward, manager Great Western Power Company; E. C. Wilson, Great Western Power Company; J. H. Brown, traffic manager San Francisco-Oakland Terminal Railways; H. W. Kimball, Kimball Electric Company; Chamber of Commerce, Commercial Club.

Sacramento—C. W. McKillip, district manager Pacific Gas & Electric Company; B. E. Hannon, district manager Great Western Power Company; J. G. Hobrecht, 1014 Sixth street.

San Diego—H. H. Jones, president San Diego Consolidated Gas & Electric Company; A. E. Holloway, contract agent San Diego Consolidated Gas & Electric Company; W. Tomkins, assistant secretary Chamber of Commerce.

San Francisco—John A. Britton, vice-president and general manager Pacific Gas & Electric Company; J. W. Redpath, secretary California Electrical Contractors' Association; Carl E. Heise, district manager Westinghouse Electric & Manufacturing Company; F. H. Leggett, manager Western Electric Company; W. W. Briggs, general agent Great Western Power Company; Dr. Thomas Addison, Pacific Coast Manager General Electric Company; C. L. Chamblin, California Electric Construction Company; T. E. Bibbins, local manager General Electric Company; E. B. Strong, Journal of Electricity, Power & Gas; H. V. Carter, Pacific States Electric Company; R. M. Alvord, General Electric Company; Robert N. Lynch, vice-president and manager Chamber of Commerce.

San Jose—J. D. Kuster, district manager Pacific Gas & Electric Company; Dan Coyle, 528 South Second street; Frank J. Somers, 38 S. San Antonio, Chamber of Commerce.

Santa Barbara—R. H. Sterling, manager Santa Barbara Gas & Electric Company; J. S. Reynolds, Reynolds Electric Supply Company.

Stockton—Samuel Kahn, manager Western States Gas & Electric Company; H. H. Adams, manager Oro Electric Company; L. G. Yondall.

Arizona.

H. L. Aller, manager Pacific Gas & Electric Company, Phoenix, Ariz., and Frank E. Russell, manager Tucson Gas & Electric Company, have been named as Arizona committeemen.



Dealers at Portland, June 28, 1916.

Utah.

S. R. Inch, operating manager Utah Power & Light Company; A. R. Loughborough, manager Western Electric Company; W. Scott, president Electric Club; R. W. Nichol, president Capitol Electric Company; R. J. Dunwoody, sales manager Inter-Mountain Electric Company; John C. Jones, manager Westinghouse Electric & Manufacturing Company; E. H. Eardley, Eardley Bros. Co.; W. R. Putnam, sales manager Utah Power & Light Company; H. D. Randall, manager General Electric Company; H. D. Howell, district manager Westinghouse Lamp Company, and S. H. Clay, secretary Commercial Club, all of Salt Lake City, have been named as Utah committeemen.

Oregon.

Franklin T. Griffith, president Portland Railway, Light & Power Company; J. A. Cranston, manager General Electric Company; J. R. Tomlinson, Pierce-Tomlinson Electric Company; O. B. Coldwell, general superintendent Portland Railway, Light & Power Company; J. Ryan, manager Western Electric Company; H. S. Wells, Pacific Power & Light Company; A. C. McMicken, sales manager Portland Railway, Light & Power Company; George G. Bowne, assistant sales manager Northwestern Electric Company; C. L. Wernicke, manager Westinghouse Electric & Manufacturing Company; F. C. Green, E. L. Knight & Company, and C. M. Will, Fobes Supply Company, all of Portland have been named as Oregon's committeemen.

Washington.

Aberdeen—P. A. Bertrand, manager Grays Harbor Railway & Light Company.

North Yakima—Geo. C. Sawyer, local manager, Pacific Power & Light Company; W. B. Hillman, Hillman Electric Company.

Seattle—A. W. Leonard, President Puget Sound Traction, Light & Power Company; H. J. Gille, sales manager Puget Sound Traction, Light & Power Company; Harry Byrne, North Coast Electric Company; R. G. Logan, Consumers' Gas Appliance Company; W. H. Byers, president State of Washington Electric Contractors and Dealers, NePage, McKenny & Company; J. I. Colwell, manager Western Electric Company; George R. Cooley, Buxbaum & Cooley; C. P. Stevens, Westinghouse Lamp Company; J. J. Agutter, president J. J. Agutter Company; Chamber of Commerce.

Spokane—D. L. Huntington, President Washington Water Power Company; M. C. Osborn, commercial agent, Washington Water Power Company; H. L. Bargion, Washington Electric Supply Company; E. A. H. Stevenson; Lewis A. Lewis, assistant commercial agent, Washington Water Power Company, Chamber of Commerce.

Tacoma—L. H. Bean, manager Tacoma Railway & Power Company; Geo. W. Rounds, general superintendent Tacoma Railway & Power Company; Wm. S. Anderson, Home Electric Company; A. F. Douglas, H. M. Byllesby & Company; J. G. Parkhurst, general manager Tacoma Electric Fixture Supply Company; Wm. A. Mullins, W. A. Mullins Electric Company; Commercial Club, Chamber of Commerce.

Walla Walla—C. S. Walters, manager Pacific Power & Light Company; L. C. Sutherland, Electric Supply & Fixture Company.

Montana.

J. F. Roche, general manager Montana Power Company at Billings; F. M. Kerr, general superintendent Montana Power Company; Jacob Duhan, Montana Electric Company; Chas. Austin, secretary Chamber of Commerce of Butte; W. C. Callaghan, general manager Helena Light & Railway Company; W. B. MacDonald, Northern Idaho & Montana Power Company, and A. J. Mosby, Northwestern Electric & Supply Company, at Kalispell; C. H. Christensen, manager Missoula Light & Water Company, have been named as Montana committeemen.

Idaho.

W. T. Wallace, Electric Investment Company; O. G. F. Markbus, general manager Idaho Railway, Light & Power Company; H. D. Pope, Pope Electric Company, Commercial Club of Boise have been named as Idaho committeemen.

Nevada.

T. B. Mechling, district manager The Nevada-California Power Company at Goldfield; Geo. A. Campbell, general manager Truckee River General Electric Company, and F. V. McAvoy, president and general manager Reno Electric Works, at Reno, have been named as Nevada committeemen.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Oakland, Antioch & Eastern Railway to issue two promissory notes, one for \$15,000 and the other for \$10,000 to the First National Bank of Oakland, interest at six per cent, and maturing not later than June 30, 1917. The company is permitted to pledge \$42,000 of its bonds and securities for these notes, which are to reduce similar notes outstanding.

The commission has approved a trust deed submitted by the Corona Gas & Electric Light Company, under which the company will issue first mortgage six per cent fifty year bonds.

NEWS OF OREGON PUBLIC SERVICE COMMISSION.

The commission has issued a general order pertaining to vertical and horizontal clearances upon all railroads and street railways within the state.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The Utah Power & Light Company has been granted a certificate of public convenience and necessity at Downey, Bannock County, Idaho, thus confirming a franchise granted March 7, 1913, before the public utilities act became effective.

SUGGESTIONS FOR ELECTRICAL DEALERS.

At a meeting of the Retail Section of the Contractors' and Dealers' Association of San Francisco it was suggested that a list of items sold be listed, so as to see the proportion of appliances sold by the retailers. It was also discussed at the meeting the advisability of starting a campaign of education, so that the people will do their buying in retail shops instead of department stores and hardware shops. The idea was that each one participating will agree to contribute a certain amount for about six months.

TRADE NOTES.

Kelman Electric & Mfg. Company of Los Angeles have closed up the Electric Washing Machine department of their business, having sold their electric washer patents, business and good will to the P. A. Geier Company of Cleveland, Ohio, who are preparing to manufacture the electric washer in large quantities and to conduct an aggressive sales campaign all over the country. Kelman Electric & Manufacturing Company will continue the manufacture of high voltage switches and circuit breakers.

A motion picture devoted to the electric washing machine and iron has made its appearance under the attractive title "The Education of Mrs. Drudge." This film devotes its 1000 ft. to show how a woman shackled to the old fashioned wash tub is emancipated and made happy by the purchase of an electric washing machine and iron. It's advertising of course, but advertising that is subordinated to human interest; and it thereby gets across its double message. The picture has been produced by the Western Electric Company and is furnished to central stations and electrical dealers to further their sales of the commodities. Western Electric offices are booking them for advance production.



NEWS NOTES



INCORPORATIONS.

SPOKANE, WASH.—Sumpter Power & Water Company, \$100,000, by R. E. Strahorn, W. E. Weed.

BEAVER, UTAH.—The Manderfield Irrigation & Reservoir Company has been incorporated here.

SAN FRANCISCO, CAL.—McFell Electric Company, \$10,000, shares \$10 each, subscribed \$9000, by F. W. Watts 859 shares, Grace Watts 40 and J. W. Henderson 1.

RENO, CAL.—Articles of incorporation have been filed with the county clerk by the Eagle and Honey Lakes Exploration Syndicate, capitalized at \$50,000 with 50,000 shares at \$1 each. The principal office of the company is located in Reno, but the articles provide that an office may be established in Lassen county, Cal. The incorporators are D. S. Dickerson, Carl J. Young, and E. M. Young. This corporation will take over the reservoir site and water rights of Carl J. Young situated in Lassen county, for the purpose of disposing of them to the settlers.

ILLUMINATION.

SANTA ROSA, CAL.—The Wilson Lighting District will be organized as the result of a recent election.

BANNING, CAL.—A movement is on foot here for the city to purchase the lighting plant of the Banning Gas & Lighting Company.

NOVATO, CAL.—The Novato Utilities Company has been granted a 25 year franchise to operate an electric light and power service in this district.

SAN LEANDRO, CAL.—Mayor Allen E. Pelton and the trustees have inaugurated a campaign for the installation of electroliers along East Fourteenth street.

LOS ANGELES, CAL.—The contract for improvement work in the Graham Lighting District has been awarded to the Southern California Edison Company.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to July 24th for furnishing lighting fixtures for the hall of records, in accordance with plans and specifications on file with the board.

TUSTIN, CAL.—The bid of the Southern California Edison Company for furnishing lights for the Tustin lighting district at \$1.15 per 32 c.p. tungsten lamp per month, has been accepted by the board of supervisors.

SAN MATEO, CAL.—Hayward Park boosters have launched a movement for the installation of electroliers in the district bounded by Ninth and Sixteenth avenues and El Camino Real. A petition has been presented to the San Mateo trustees.

LOS ANGELES, CAL.—A petition has been received by the city council from E. O. Engstrum, et al., asking that centrifugally made concrete lighting standards be used in the ornamental lighting system proposed for Washington street from Main to Vermont.

EL PASO, TEX.—The Rotary Club lighting committee is making plans for having a number of the downtown streets illuminated with electric arcs. Streets being considered for the new lighting are San Antonio, Oregon, Mesa avenue, Stanton, Mills and Texas.

TRANSMISSION.

PORTERVILLE, CAL.—Construction crews from the Mt. Whitney Power Company have started work on new service lines to the Doyle Colony, where a number of new places are being developed.

SPOKANE, WASH.—Porter Brothers of Spokane have been awarded the contract for building a steam heating and

electric power plant for the Spokane Heat, Light & Power Company at \$88,000, by E. Darrow, manager.

SOUTH BEND, WASH.—The next move on the part of the Willapa Power Company will be the construction of a dam on the South Fork. Manager Nettleton says that the dam will be of fir timbers, and 24 ft. high. There will be a pipe line about 700 ft. long from the dam to the power plant.

SEASIDE, ORE.—The council has passed an ordinance which extends for a period of 25 years the franchise held by the Pacific Light & Power Company. Floyd J. Keys, manager of the company's interests in Seaside stated that the erection of a high tension power line from Astoria to Seaside will commence at once.

EL PASO, TEXAS.—All overhead electric and power wires in the business district are to be placed underground in conduits at a total cost of \$325,000. Work will be started as soon as materials can be assembled which will probably be within 90 days. Stone & Webster are owners of the street railway and lighting properties of El Paso.

PRESTON, IDAHO.—The gigantic power project of the Utah Power & Light Company at Grace, Idaho, promises to be the largest one installed in the intermountain country. Two million ft. of lumber will be put into flumes, 100 carloads of cement will be used in dams, etc., and 800 tons of reinforced steel will be used. The canal at Bear Lake will be widened to 60 ft.

JOHN DAY, ORE.—Transmission of electric power over the new lines of the Prairie Power Company has commenced. So far, power is only being delivered to the gold dredge, but it is intended soon to furnish John Day and Canyon City with lights and power from the same source. The extensions and improvements made by the Prairie Power Company in the past year have involved the expenditure of nearly \$50,000.

PRESCOTT, ARIZ.—Immediate construction of a plant by the Arizona Hydraulic Power Company undertaking to generate electricity by water storage, is assured, it is stated by E. H. Meek. The plan is to generate electrical power for copper camps of Gila county. Surveys have been run from Verde River. The length of the transmission line will be about 70 miles. It is probable that active construction work will begin within 60 days.

TELEPHONE AND TELEGRAPH.

GILROY, CAL.—The Gilroy Investment Company has let the contract for the erection of a telephone building to cost \$6760.

SAN FRANCISCO, CAL.—An ordinance has been passed granting permission to the U. S. Government to lay conduits in the streets of this city for operating telephone service and other governmental uses.

PETALUMA, CAL.—At the annual meeting of the Petaluma Telephone Company, the following directors were elected: D. W. Long, D. M. Winans, S. L. Stice, E. P. Nisson, T. G. King, C. P. Christiansen, J. J. Bergstedt, G. W. Gaston, John R. Denman. The members decided to increase the telephone rates from \$10.50 to \$12 per year.

DOUGLAS, ARIZ.—Improved Western Union service in Douglas, as well as other Arizona towns is promised as the result of a visit from Hugh McPhee, district superintendent of the company. A new quadruplex instrument will be installed in the office here and a generator will take the place of gravity batteries now in use. A new line from Nogales to Tucson has been authorized also.

TRANSPORTATION.

DUNCAN, ARIZ.—The Carlisle Mining Company is planning the erection of a modern electrical power plant at Duncan and an electric railway, between Duncan and the mines at Steeplerock, N. M.

SANTA ANA, CAL.—The Pacific Electric Railway Company and its assigns have been granted the right to construct and operate a standard gauge double track curve connection between its double track railroad on Fourth street and its double track on Main street.

SANTA ANA, CAL.—It is stated that the Pacific Electric Company will lower its grade through the Garden Grove section for a length of track of 2800 ft. The track will be lowered 3 ft., 4 inches, leaving the same only 20 inches above the general grade of the land. Culverts will be placed where needed.

IRRIGATION.

KALISPELL, MONT.—J. A. Green, general manager of the North Idaho and Montana Power Company, is considering the construction of a power pumping scheme here.

RED BLUFF, CAL.—A project has been launched involving the irrigation of all Antelope Valley, about 5000 acres. It is proposed to install a big pumping station in the Sacramento River.

MONTAGUE, CAL.—A. L. Harlow has purchased 1800 additional acres of land in the vicinity of Grenada. His holdings now in that vicinity are about 5000 acres and he intends to put the entire tract under water and subdivide it into small tracts.

STOCKTON, CAL.—Engineer Walter G. Hunter has estimated that it will cost \$285,000 to carry out the plans of the West Side Irrigation District which proposes to water a section in the vicinity of Tracy from the Old River, a branch of

the San Joaquin River. A bond issue of \$295,000 will be voted on.

SACRAMENTO, CAL.—By voting \$90,000 worth of bonds at a special election, the residents of the Carmichael colonies, a tract east of this city, have assured the first irrigation district under the Wright act in the Sacramento Valley. There were 41 votes in favor of bonding the district for \$90,000, and only five voted against the proposition.

RENO, NEV.—Water sufficient to irrigate from 25,000 to 30,000 acres of land will be conserved by the new irrigation dam which will probably be erected this year on the Truckee River in the Pyramid Lake Indian reservation. The sum of \$85,000 was appropriated by the present Congress for irrigation on the Pyramid reservation. Of this sum \$30,000 was set aside for a concrete dam across the Truckee, and the remaining \$55,000 is to be used in the construction of ditches and flumes.

VINA, CAL.—Three huge trestles are being constructed by the Stanford Vina ranch for carrying corrugated iron flumes across canyons to connect sections of the \$35,000 irrigation ditch, recently completed by the Chico Construction Company for the Stanford ranch. The trestles are about 30 ft. high at their highest point and are to cost approximately \$10,000. Water will be carried from the new dam on Deer Creek through this ditch, to a tract of bottom land about three miles north, and used for irrigation.

SACRAMENTO, CAL.—An irrigation system to supply water to land in eastern and central Solano county and to orchards in Suisun Valley is proposed by men financially interested in Solano. The system is to cover 20,000 acres to 30,000 acres. Tentative plans call for the taking of water from the Sacramento River through one of the sloughs or dredge canals, probably on the west Sacramento project in Yolo County, opposite Sacramento. Pumps would be used to lift the water into a higher canal that would convey it to the district to be watered.

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, JULY 15, 1916

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BY WILLIAM STRONG.

RATE OF DEVELOPMENT OF IRRIGATION PROJECTS.

BY S. T. HARDING.

PROSPECTIVE MARKET FOR IRRIGATION PUMPING.

BY JOSEPH JACOBS.

FILTRATION PLANT AT IDORA PARK.

BY E. C. EATON.

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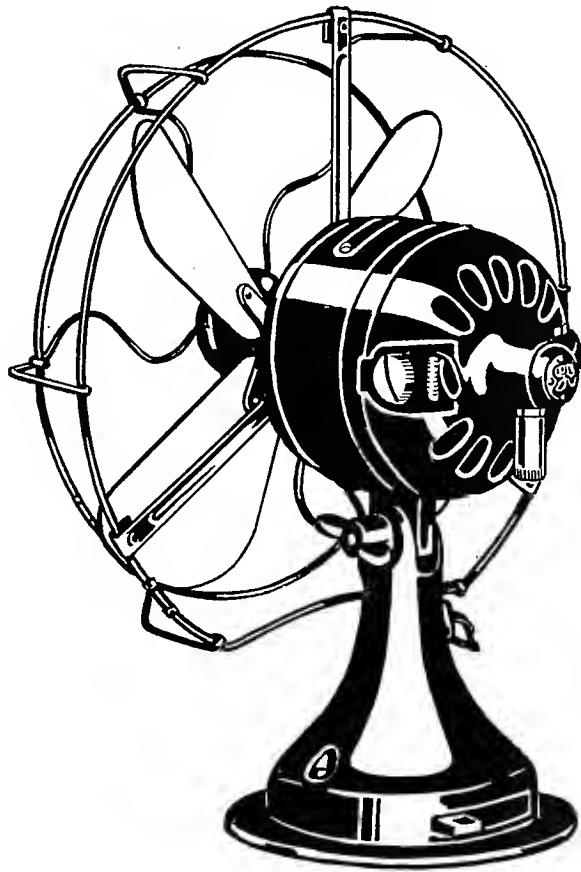
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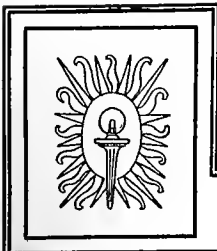
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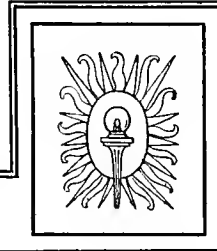
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ELECTRO-METALLURGICAL USES OF SURPLUS POWER

BY WILLIAM STRONG.

The problem of Western use of surplus electric power confronts a number of Western hydroelectric projects and the purpose of this paper is to suggest a possible solution. All electrochemical and metallurgical plants operating in Europe and in the United States receive their electric power at a cost ranging from about \$3 per kw.-yr. in Norway to \$20 to \$30 in Germany and at Niagara Falls, the larger plants using from 18,000 to 30,000 electrical horsepower, continuous service. While these rates would not yield much direct profit to an operating hydroelectric company, profit should be obtained indirectly by increase of

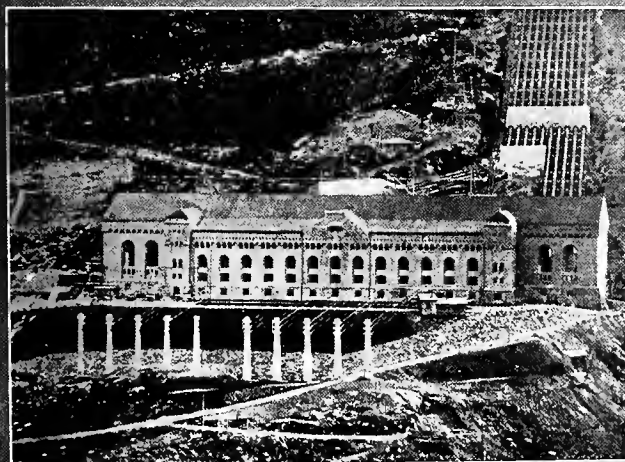
population and consequent market for domestic consumption.

Whether or not it may be profitable for any particular hydroelectric company to engage in the manufacture of any of the products mentioned in the following lists depends upon several conditions and each case should be the subject of special study.

The principal factors to be considered may be stated as follows:

Quantity of electric power available for continuous use and low cost of same to the manufacturer.

Location of proposed electrochemical or metal-



Close View of Power Plant and Steel Pipe Lines at Rjukan, Norway.

Interior of Power Plant at Rjukan.

Power Station at Lienfos, Norway, Developing 20,000 h.p., all of which is Used in the Manufacture of Nitrate of Lime at the Notodden Nitrate Factory.

Power Station at Svaelgpos, Norway, Developing 40,000 h.p., all of which is Used in the Manufacture of Nitrate of Lime at the Notodden Nitrate Factory.

lurgical works with reference to raw materials, railroads and markets.

Freight rates on raw materials and finished products.

Available raw materials, cost and quality of same.
Cost and supply of labor.

At the present time the following electrochemical or metallurgical products are manufactured:

In Europe—

Nitric acid by fixation of atmospheric nitrogen.	Calcium cyanamide.
Nitrates of ammonia, lime, etc.	Sodium cyanide, caustic soda, etc.
Hydrochloric acid, chlorine, etc.	Ferro-silicon, ferro-carbon, etc.
Calcium carbide.	Tungsten metal and alloys.
	Aluminum and alloys.

In the United States, principally at Niagara Falls—

Aluminum.	Tungsten metal and alloys.
Carborundum.	Titanium bronze.
Calcium carbide.	Silicon-copper, Manganese-copper.
Chlorinated lime.	
Chlorate of potash, caustic soda, etc.	Steel castings.
Ferro-silicon.	Zinc refining.
Graphite, electrodes, etc.	Copper reduction from ores.
	Zinc reduction from ores.

Nitrates.—The nitrogen problem of the day is being solved by electricity and offers an opportunity for the utilization of cheap electrical power where transportation and market conditions are favorable.

According to a special report on the Utilization of Atmospheric Nitrogen by the U. S. Consul at Chemitz, Germany, the United States, before the European war commenced, was sending annually over \$32,000,000 abroad for the purchase of nitrogen products. Over one-half of this amount went to Chile for crude sodium nitrate, Chile saltpeter. The nitrate beds of Chile are approaching exhaustion and on account of the increase in price of both raw material and finished products it is now possible for the electrochemical plants in Norway and Germany to successfully compete with production from Chile nitrate by the fixation of nitrogen from the air and the manufacture of nitric acid and other products.

During the latter part of the 18th century the discovery was made that an electric spark passing through the air caused an acid reaction. Since that time the problem of chemically combining the oxygen and nitrogen of the air has engaged the attention of many scientists. Up to 1899 but little progress seems to have been made outside of laboratory experiments and demonstrations. During 1899 MacDougal and Howles erected a small nitric acid plant in England in which eight arcs were arranged in a row and the alternating current of a dynamo of 7500 volts and 50 cycles was used. It produced from air 34 grams of nitric acid per kw.-hr. Many mechanical difficulties were encountered and an industrial plant was not attempted. Since 1899 great progress has been made in the perfection of mechanical details. In 1911 Birkeland and Eyde successfully established a plant for the manufacture of nitric acid by combining nitrogen and oxygen of the air. This plant was located at Notodden, Norway, where 55,000 electrical horsepower was in use and over 400 workmen employed. Thirty-two 4000 kw. furnaces were in operation requiring 35,000

cu. ft. of air per minute. The reaction took place at a temperature of about 3000 deg. C., 2 per cent of the nitrogen in the air passing through the furnaces was oxidized to nitric acid, equivalent to a production of 70 grammes of nitric acid per kw.-hr. The cost of electricity used at the Notodden works is reported to be \$2.94 per electrical hp.-yr.

The nitrogen fixation furnaces used is described as follows:

The individual furnace may be described as a low, wide cylinder resting upon its side and placed between the arms of an enormous horse shoe magnet. The cylinder is made of heavy iron plate and consists of similar halves which are bolted together. The interior is lined with refractory brick so arranged that in the middle there is a narrow, circular chamber, over two meters in diameter and 10 centimeters in width. In this circumscribed space the reaction takes place. The huge terminal poles of the wrought-iron electro-magnet, hevelled at the extremes, are imbedded in the chamotte lining and are about 22 centimeters apart, their axis corresponding with that of the chamber. The electrodes are of copper with internal circulation of water and are 1.5 centimeters in diameter. They enter the chamber from opposite sides and are separated from each other at its centre by an interval of 2 millimeters. Air under pressure is admitted to passages between the external shell and the chamotte lining and enters through numerous small inlets in the latter into the reaction chamber. The gaseous current issues, through openings in the periphery of the chamber, into a conduit which leads to the absorption apparatus. A small window of mica in the front of the furnace allows inspection of the operation. A direct current feeds the coils of the big magnet placed immediately outside the iron shell and an alternating current is connected with the electrodes. This current is of 5000 volts, 50 cycles. When in uninterrupted operation the electrodes are changed every three or four weeks while the refractory lining is removed once or twice a year. Repairs are easy to make and the cost slight. A series of such furnaces may be kept in operation for weeks without special regulation and reveal exceedingly slight variations in energy.

Research chemists and electrical engineers have been constantly at work improving the details of the process and construction of electric furnaces and it is probable that nitrogen fixation plants can now be designed of much higher efficiency than that described.

In general it may be stated that under present and future conditions of the nitrate industry and the increasing demand for nitric acid and nitrates in the manufacture of explosives, fertilizers, etc., it is probable that some of the hydroelectric plants of the West are so situated that their surplus electrical power could be profitably used in the manufacture of nitrogen products.

As an indication of the importance of this subject Congress has passed a bill providing for the appropriation of \$20,000,000 for the construction of nitrogen fixation plants. The main features of this bill follow:

The President of the United States is authorized to cause to be made, such investigation as in his judgment is necessary to determine the best, cheapest, and most available means for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers and other useful products by water power and any other power as in his judgment is the best and cheapest to use; and is also authorized to designate for the exclusive use of the United States, such sites upon any navigable or non-navigable rivers or upon the public lands, as in his opinion

will be necessary for carrying out the purposes of this act; and is further authorized to construct, maintain, and operate, at or on any site or sites so designated, dams, locks, improvements to navigation, power houses and other plants and equipment or other means than water power as in his judgment is the best and cheapest, necessary or convenient for the generation of electrical or other power and for the production of nitrates or other products needed for munitions of war and useful in the manufacture of fertilizers and other useful products.

The products of such plants shall be used by the president for military and naval purposes to the extent that he may deem necessary, and any surplus which he shall determine is not required shall be sold and disposed of by him under such regulation as he may prescribe.

The sum of \$20,000,000 is appropriated out of any moneys in the Treasury not otherwise appropriated, available until expended to enable the President of the United States to carry out the purposes herein provided for. The plant or plants provided for under this Act shall be constructed and operated solely by the government and not in conjunction with any other industry or enterprise carried on by private capital.

In order to raise the money appropriated by this Act and necessary to carry its provisions into effect, the Secretary of the Treasury upon request of the President of the United States, may issue and sell or use for such purpose or construction hereinabove authorized any of the bonds of the United States now available in the Treasury of the United States under the Act of August 5, 1909, the Act of February 4, 1910, and the Act of March 2, 1911, relating to the issue of bonds for the construction of the Panama Canal to a total amount not to exceed \$20,000,000; provided, that any Panama Canal bond issued and sold or used under the provisions of this section may be made payable at such time after issue as the Secretary of the Treasury after date of issue as the said Act of August 5, 1909, not exceeding \$50.

Carborundum.—At Niagara Falls the Carborundum Company's plant, covering about 15 acres, has a capacity of 12,500,000 lb., annually, of abrasives. They operate 30 of the largest and hottest electric furnaces in the world. Carborundum is the trade name given to carbide of silicon. The element carbon is supplied by crushed coke and silicon by sand. These two materials, together with sawdust and sand, are mixed in certain proportions and loaded into the electric furnace, which is a large rectangular affair built of fire brick. It is about 20 ft. long, 7 ft. wide and 6 ft. high. At each end of the furnace are thick cables connected to carbon electrodes. Through the mixture of coke, sand, sawdust and salt the current is turned on and a heat approximating 7000 deg. F. passes through the crude materials. Eighteen thousand h.p. of electric energy generated by Niagara Falls is used.

Calcium carbide is manufactured in Norway and other points in Europe where cheap power is available as well as at Niagara Falls, Sault Ste Marie, Duluth and other points in the United States. Fifty-six carbide plants are reported in operation in Europe and sixteen in the United States and Canada. The larger plants abroad and in this country require from 30,000 to 40,000 electrical horsepower. In the manufacture of calcium carbide limestone as free as possible from magnesia and alumina is used together with ground coke or anthracite coal. Burnt lime and ground coke or coal in about equal parts are charged into an electric furnace of special type and the mixture is raised to a temperature of about 3000 deg. C. when

chemical union of the calcium and carbon takes place.

At some European plants calcium carbide is made the basis of the manufacture of calcium cyanamide. This is accomplished by heating the ground carbide in an atmosphere of nitrogen.

Calcium cyanamide containing 35 per cent nitrogen,—more than twice the amount present in Chile saltpeter,—when properly used, has proved to be an excellent nitrogen fertilizer for many crops and quite equal to ammonia compounds into which it can be readily converted. The cost of manufacturing calcium cyanamide in Norway is stated as being \$22 per ton.

Aluminum.—The raw material from which this metal is usually made is bauxite, deposits of which occur in Georgia, Arkansas, Alabama and elsewhere. The amount of bauxite mined in 1907 is stated as being 260,000 tons, three-fifths of which was produced in France. The present electrochemical process of manufacture involves the following stages:

(a) Hydrate of alumina is precipitated from a solution in which the metal is present as sodium aluminate.

(b) The precipitate is calcined at a temperature of about 1100 deg. to 1200 deg. C.

(c) The calcined precipitate is treated in an electric reduction furnace.

The reduction furnace for aluminum consists essentially of an iron casing lined with carbon. The electrodes vary in size and form in different works. Their total sectional area is adapted to the current used. In starting a furnace it is usual to first introduce cryolite which is brought to fusion by electrical heat. Calcined alumina hydrate is then gradually fed in at the surface of the fused cryolite and as it dissolves the resistance gradually falls 5 or 6 volts and the temperature of the bath will generally be about 1000 C., at which temperature electrolytic reduction of the metal takes place.

Carbon electrodes, an important item of expense in the operation of electric furnaces, are made from bituminous or anthracite coal, coke, retort carbon, natural or artificial graphite, soot, oil cake, etc. A process for making electrodes for the manufacture of aluminum is described as follows: Oil and coke is ground with the admixture of tar or other binder material and is subjected to high pressure in moulds. The pressed shapes are then baked in a specially designed kiln, the surface of the electrodes being protected by embedding them in carbon.

According to the Transactions of the American Electrochemical Society and other publications a large amount of experimental and research work has been done in efforts to attain commercial success in the design of electric furnaces for making steel castings, reduction of tungsten and the manufacture of tungsten alloys, titanium bronze and the reduction of all metals requiring a high temperature and electrical treatment.

The electrolytic reduction of zinc from certain ores is reported to be in successful operation.

Regarding electro-chemical and metallurgical processes the technical knowledge of the processes is generally well advanced but there is a large field for research laboratories where the mechanical problems in the design of commercial plants may be solved.

ELECTRIC POWER FOR IRRIGATION PUMPING

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RATE OF DEVELOPMENT OF IRRIGATION PROJECTS.

The rate of development of any undertaking is of importance in determining the period during which such development is only partially used and the amount of operation cost which has to be carried until a going concern is established. This is of particular importance for irrigation systems where such non-productive or partially productive periods are longer than in many other forms of industrial development, so that the interest charges on the construction cost during this period may be quite large. It is also of importance to power companies supplying large pumping units, as the rate of extension of the irrigated area is a measure of the rate of increase in the power consumption.

For small individual systems, such as pumping from wells or for small gravity canals, diverting for only one or two farms,—a type of development usual in the earlier days in the mountain states,—the rate of extension of use depended on the efforts of those constructing the ditches. In the larger systems, more typical of present developments, the use of the water and actual preparation and irrigation of the land usually depends on others than those constructing the systems. It is often necessary for those making the development to secure the settlers who are to use the land and water. In such cases longer periods are required for the actual cultivation of the land and the full use of the canal capacity. This is true also of the larger developments made by the land owners under some of the forms of co-operative organization.

The need of longer periods for the actual application of water to beneficial use on the larger units usual in present new systems has been recognized by changes in the laws of the different states. In order to acquire water rights by appropriation, diligence in construction and actual use of the water is essential. For the earlier systems the usual statutory period for completing an appropriation was five years. This has been found to be too short, and a total of 14 years for construction and use may now be allowed in some states, while in others authority is given to the state engineer, or other equivalent officials, to fix the period of time for each appropriation. The latter method is preferable, as it allows the time to be adjusted to the magnitude of each case.

The rate of increase in irrigated area varies widely with different systems. There are instances where the full area under a canal has been placed under cultivation in a few years. There are other instances where, due to inherent weakness in the development, such as poor water supply, soil, or excessive costs, the extension of the irrigated area has been very slow. A change in conditions, such as a failure to realize anticipated profits from the crops, may cause an actual decrease in the area irrigated. There is, however, some range of rate of development which is representative of well-handled feasible projects under normal condi-

tions. Available records from different sources are given in the following discussion.

In the 13th U. S. Census, taken in 1910, the acreage actually irrigated in 1909, the total acreage under the canal and the date when each system was initiated was secured for each canal. From this information, the percentage of the total area irrigated for the number of years since each system had been initiated was figured. In a recent book (*Irrigation in the United States*, D. Appleton & Co.) by R. P. Teele, who was in charge of the last irrigation census, the results for 522 canals supplying 5000 acres or over are plotted, a mean curve for the percentage irrigated for different ages being drawn. This is reproduced in Fig. 1. The

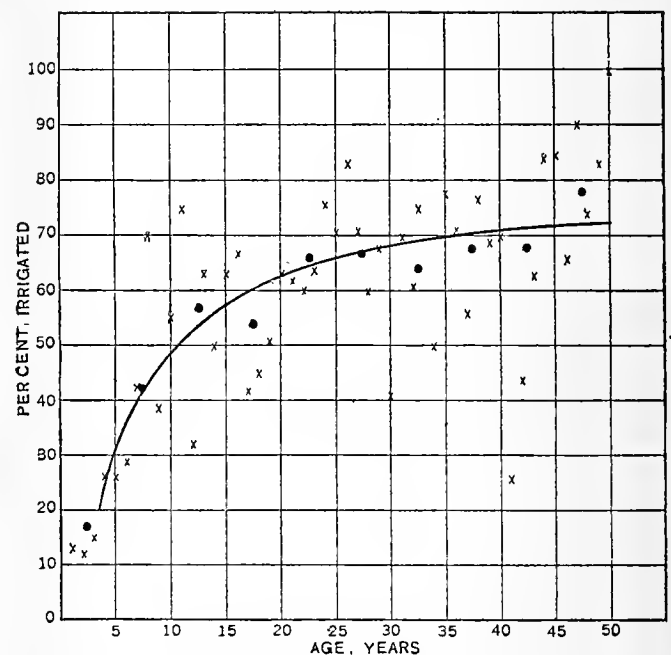


Fig. 1. Average Increase in Rate of Irrigated Area from Date of Initiation of Systems.

number of records available for systems operated over 40 years are relatively few, and this part of the curve is not as definite as that for shorter periods of time.

It is noticeable that this curve, even for systems in use over 30 years, shows but little over 70 per cent of the area to be actually irrigated. The total area for which systems were completed in 1910 was given by the census as 19,340,000 acres, the area actually irrigated in 1909 was 13,740,000 acres or 71 per cent of the area available.

From these figures Mr. Teele draws the conclusion that at the end of ten years from its initiation, the average irrigation project is watering about fifty per cent of its land; at the end of twenty years it is watering a little more than sixty per cent; at the end of thirty years it is watering less than seventy per cent, and at no time will it water more than seventy or eighty per cent of its land.

These figures include both the construction period and the settlement period. The length of each of these periods for any project depends on different con-

ditions which may be independent of each other. It would seem preferable to consider them separately. The length of time required for construction depends on the physical conditions of the particular project and the financial condition of its promoters. The time for physical construction can be closely estimated for different financial programs. Delays due to financing are distinct from delays due to the failure to actually irrigate the land after the project is in operation. The rate of increase of the irrigated area depends mainly on agricultural conditions and the efforts of those using the land; the time of construction depends on engineering conditions and the efforts of those constructing water works.

The data from the general census only give the conditions for one year in the history of each system. Probably a better average can be secured by taking the complete history of different systems and plotting the percentage irrigated each year for a series of years. The only group of systems for which such data are available are those of the U. S. Reclamation Service. In Table I the results for various of these projects are given. The total completed acreage in each project on which the percentages are computed are those given in the 14th Annual Report of the Reclamation Service. This total is the area for which water could have been supplied in 1914; many of the projects will ultimately contain larger acreages. The areas irrigated in each year were secured from the different published reports.

The times are dated from the first year of operation. As on most of the projects, certain portions were completed and placed on an operation basis before the completion of the whole project, these figures, in some cases, may be somewhat incorrect. The total area used for computing percentages is that given as ready to be irrigated in 1914; in a few cases additional units were added in 1915 so that the percentages may be somewhat high for the last year shown. Such factors will affect the figures for some individual projects; the general average should be as dependable as can be expected in data on questions of this kind.

There were twenty-three projects operated in 1914. Only fourteen of these are given in Table I. The remainder were omitted because they include projects

Table I.—Rate of Increase of Area Irrigated on Projects of U. S. Reclamation Service.

Project.	Area Irrigable in 1914, Acres.	Per Cent of Irrigable Area Irrigated Each Year of Operation.							
		1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.
Yuma, Arizona.....	60,000	6	11	17	17	23	33	42	46
Orland, Cal.	14,300	5	19	30	46	51	63	..	..
Minidoka, Idaho	117,000	13	21	37	39	48	60	65	70
Huntley, Mont.	28,800	14	21	28	42	50	55	59	63
Sun River, Mont.	16,400	18	26	42	42	45	40	26	..
Lower Yellowstone, Mont.	36,200	20	24	43	14	21	16	35	..
North Platte, Neb.	91,500	25	46	50	51	58	66	70	76
Truckee-Carson, Nev.	52,000	29	40	42	56	53	58	70	83
Umatilla, Oregon.	17,000	4	12	14	20	26	28	30	31
Klamath, Oregon.	38,000	23	26	57	68	63	62	50	64
Belle Fourche, So. Dak. ..	68,800	6	8	22	29	40	48	54	64
Okanogan, Wash.	10,100	14	34	44	64	72	76	77	78
Tieton, Wash.	34,000	5	21	44	55	62	65	..	..
Shoshone, Wyo.	41,200	4	22	36	39	40	47	54	62
Mean, 14 projects....	615,300	13	24	36	41	47	51	53	64

with which areas previously irrigated are included, such as projects where the Reclamation Service either purchased and enlarged old systems or supplied supplementary storage for canals previously built. For such systems the data for the operation previous to the work of the Reclamation Service is not available.

The projects given in Table I are those where new systems were built.

The period between authorization of the project and delivery of water or the construction period varied from 2 to 5 years, averaging $3\frac{1}{2}$ years. Authorization followed the general examination of the project, which required an additional period of time. In considering the time of non-productive investment for projects of this size, it would appear that interest on costs would have to be carried over an average construction period of $3\frac{1}{2}$ years, or an equivalent of perhaps 2 years on the full construction costs. This is recognized in the

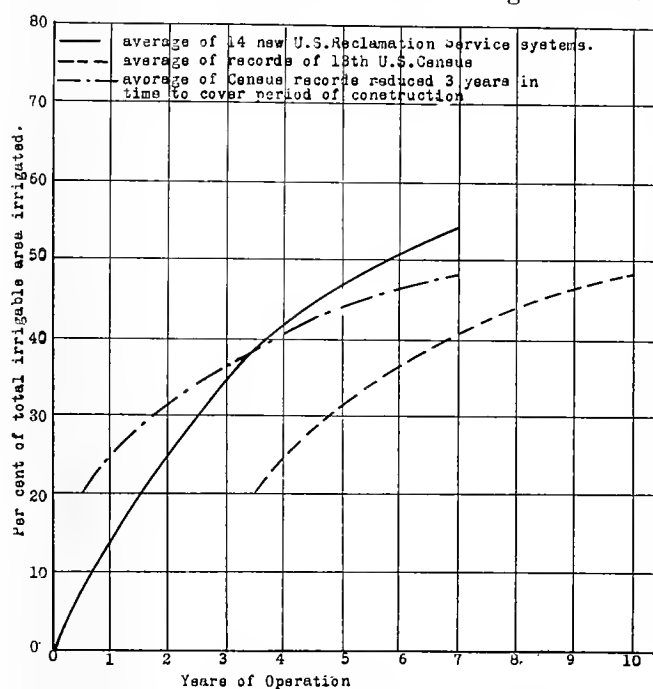


Fig. 2. Average Rate of Increase of Irrigated Area on Project.

irrigation district laws of some of the states which permit the first two years' interest on bonds to be paid from the funds received from their sale. In addition to this non-productive period, a partially productive period as shown by the rate of increase in irrigated area would have to be allowed for.

The average results of these 14 projects are plotted in Fig. 2. Records for all projects are only available for 6 years; the portions for longer times are partial averages, as indicated in Table 1. In comparison with the average curve obtained from the census, the average rate of increase of irrigated area on these Reclamation Service projects has been good.

In Fig. 2, the general curve from Fig. 1 is also plotted and the same curve reduction of three years to cover estimated average construction period. This comparison shows the government projects, as an average, to be developing more rapidly than the indicated average for the 522 systems reported by the census. On a few projects the rate of development has been slow, and some decreases have occurred. Taken on the whole, however, the average should indicate the normal rate of development to be expected on well considered projects of average feasibility. There is no evidence of different rates under different climatic conditions, each project having a development in proportion to its individual conditions and merits.

Similar records for other forms of organization are not available. Individual examples showing both slower and also more rapid increases in irrigated area could probably be secured. Whether the average curve for other forms of organization would be below or above the curve for the Reclamation Service cannot be stated. The largest source of difference would be caused by the more favorable financing of the government projects, as the delays due to lack of funds for completion which have occurred with many systems financed by private means have not been serious with the Reclamation Service.

The wide variation in rate of development that may occur under generally similar climatic and soil conditions can be illustrated by three irrigation districts in California. The Modesto Irrigation District spent a period of 16 years in construction, the largest part of this being due to legal controversy, and required 10 years' operation before one-half the land was irrigated. The adjoining Turlock District similarly spent 13 years in construction and 14 years in operation before one-half the area was irrigated. The South San Joaquin Irrigation District did not organize until some years after both of these districts were under operation. Construction was completed in about four years, and now in its third year of operation about 40 per cent of its area is irrigated. The difference is due to a higher land value and cost of the irrigation system and to the construction of laterals to each farm by the district.

In the Imperial Valley, Imperial Water Company No. 1 was irrigating 80 per cent of the land under it in nine years after delivery began, this period including that covering the Colorado River breaks. The more rapid rate here is probably due to the greater aridity of the climate and the inability to secure any returns from the land without irrigation.

These results indicate that a normal rate of development to be expected on large projects will result in having one-half the area irrigated in about 6 years after operation begins, or about 9 or 10 years from the beginning of construction. An additional period of three years should increase the irrigated area to about 60 per cent of the total. Under usual conditions, the actual irrigation of about eighty per cent of the irrigated area would be considered complete development. On systems lacking some of the essential elements of feasibility, the rates of progress may be only one-half as rapid, or actual decreases may occur. Interest charges must be carried over these periods to a greater or less extent and also some operation deficit. Where only a portion of the lands are in use, it is not generally possible for such lands alone to carry the actual cost of operation and maintenance of the whole system. Some means of assessing lands not irrigated or the carrying of such deficits in construction accounts must be provided. The present tendency is to extend the time of payment for the lands and irrigation system. This increases the capital required by the constructing organizations.

Where large pumping plants are used for irrigation, the power consumption per acre irrigated is larger in the first years of operation than after the development has become complete. This is due to

the greater proportion of the water lost in conveyance with small flows and to the generally lower duty secured in the irrigation of new or raw lands. The curves for power consumption, if plotted on Figs. 1 and 2 as percentages of the total ultimate consumption, would, for average systems, be above the curve for the rate of increase of the irrigated area, approaching full consumption when about 80 per cent of the area was actually irrigated.

POWER REQUIREMENTS FOR IRRIGATION PUMPING.

The units commonly used to express the results accomplished in pumping for irrigation are gallons per minute and second feet for rate of use and acre feet

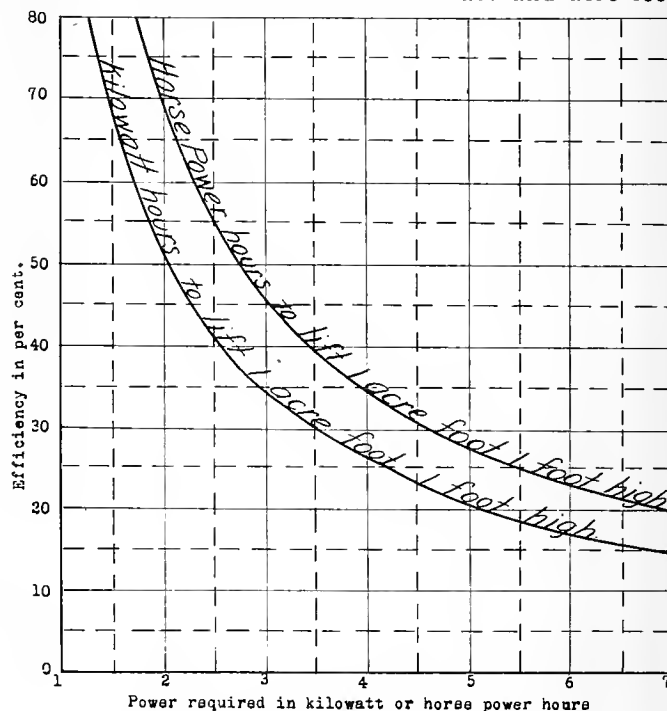


Fig. 1 Power Required to Lift 1 Acre Foot of Water 1 Foot High for Different Efficiencies.

for units of quantity. Pump ratings are expressed in gallons per minute. The use of water in relation to the area served is more usually expressed in terms of the area served per second foot of supply.

Figs. 1, 2, and 3 give the power required for pumping per foot of lift. In Fig. 1, the horsepower and kilowatt hours required to raise one acre foot of water one foot with different efficiencies are shown. The efficiency of irrigation pumping plants varies widely; on large well built plants the overall efficiency may be as high as 65 per cent over all; on small plants, poorly maintained, tests are available efficiencies of less than 20 per cent. Curves are given for both horsepower and kilowatt hours.

In Fig. 2 curves showing the power required to lift 1 second foot through a height of 1 foot for different efficiencies, are given, in terms of 100 gallons per minute. Fig. 3 gives similar curves expressed. Using a weight of 62.4 lb. per cu. ft for water, 0.1135 h.p. or .0847 kw. would be required to pump 1 sec. ft. 1 ft. high at 100 per cent efficiency. For 100 gallons per minute the corresponding figures are .0252 h.p. and .0188 kw. To lift one acre foot of water one foot high at 100 per cent efficiency requires 1.374 h.p.-hr. or 1.025

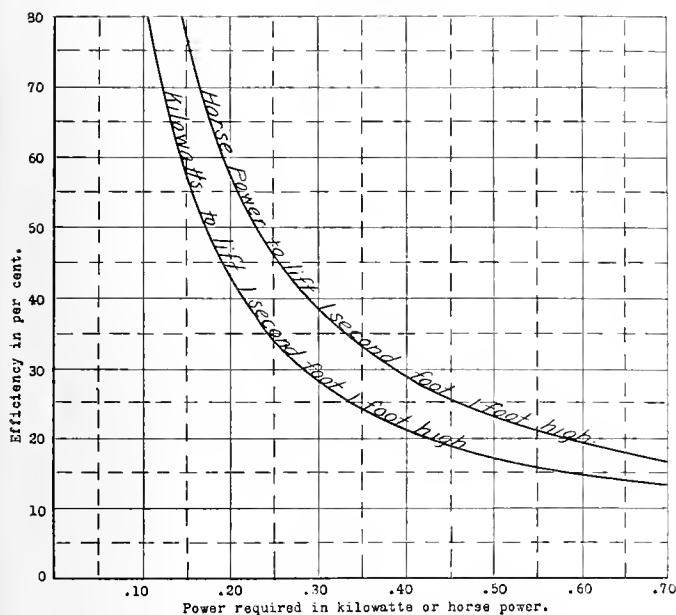


Fig. 2. Power Required to Pump 1 Second Foot 1 Foot High for Different Efficiencies.

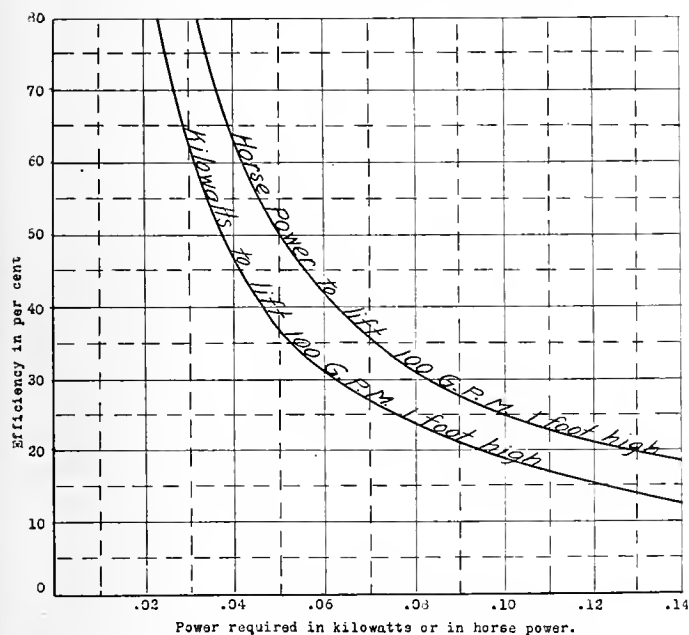


Fig. 3. Power Required to Pump 100 Gallons Per Minute 1 Foot High for Different Efficiencies.

kw.-hr. The power requirements and consumption for estimated efficiencies, secured from these curves, multiplied by the lift in any case will give the total power requirement and consumption.

Aquatic growths in canals include a large variety of plants. The long, trailing growth, sometimes called horse tail moss, which grows from the sides and bottoms of canals and may reach a length of 6 or 8 feet, is in many cases actually a flowering plant of the pond weed family which is spread by seeds. The smaller non-branching black or frog moss is actually a moss botanically and has no flowers. It spreads by fragmentation, the breaking off of parts of the plants and its attachment in new locations. Algae are cellular growths which occur either in stagnant water or attached to other growths or surfaces. They are able to attach themselves sufficiently firmly to even concrete surfaces so that they can resist relatively high velocities.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.

(Continued.)

Three Rivers Slope.—This project contemplates the irrigation of 42,000 acres of plateau land lying in the gore between the Snake, the Columbia and the Walla Walla rivers and just above the existing irrigation projects of the Burbank Company and the Attalia Land Company. These latter named projects serve lands, partly by gravity but mostly by pumping, up to an elevation of about 420 ft. (mean sea level), and the proposed larger project here considered proposes to reach a maximum elevation of 850 ft., contemplating a maximum lift of 487 ft. and a mean lift of 343 ft., from a pumping station located on the left or south shore of Snake River in Sec. 2, T. 9 N., R. 33 E., W. M.

The project is well located for local markets, being about equidistant from Portland, Spokane and Seattle, and its transportation facilities are exceptionally good. Besides such transportation as the Columbia and Snake Rivers may afford, the project is practically encircled by railway lines and the Eureka branch of the Northern Pacific Railway crosses the project centrally in a northeasterly direction. The estimated cost of the project is as follows:

Pumping station complete.....	\$ 460,000
Pressure mains	85,000
Main canals and distribution system.....	1,400,000
Engineering and contingencies.....	486,000
Total	\$2,431,000
Cost per acre for 42,000 irrigable acres.....	\$58.00

A possible gravity alternative for this project may be found in the Touchet River, which affords a reservoir site of good capacity, with damsite in the vicinity of Shaw, in Sec. 6, T. 9 N., R. 35 E., at which point the river elevation is about 880 ft. The ordinary summer flow of the Touchet River is all appropriated and in use for irrigation, but its flood discharge would be available. Practically no stream flow data are available for this stream from which its annual runoff could be estimated, but with a drainage area of about 600 square miles above the reservoir site and embracing an area whose annual rainfall varies from 13 in. to 36 in. per year, a mean annual runoff of from 150,000 to 200,000 acre feet might be anticipated, a large portion of which would be available for storage.

The Touchet River would probably not afford a sufficient supply to reclaim the entire 42,000 acres in the Three River scheme, but it might be made to serve the upper 20,000 acres thereof and thereby reduce the pumpage lift for the remaining lands by about 200 ft. This Touchet supply might also be considered for pumpage from the reservoir to areas above the 850 ft. level now contemplated, for these higher lands are of excellent quality and will require less leveling than the lower lands. I refer to these alternatives as possibilities which should receive consideration when more definite knowledge is had of the runoff of Touchet River, but which in the absence of such knowledge cannot be regarded so favorably as pumpage from the Snake.

Pasco Project.—This project embraces about 100,000 acres gross or 80,000 acres of irrigable land lying along the Columbia and Snake Rivers just northerly

from Pasco, exclusive however of the 20,000 acres gross included within the boundaries of the Pasco Reclamation Company's project. It contemplates pumpage in three lifts of a maximum elevation of 700 ft. above sea level, which means a maximum pumpage head, including friction losses, of 355 ft., and a mean pumpage head of 265 ft. The proposed location for pumpage station is on the Columbia River in Sec. 2, T. 10 N., R. 28 E., W. M.

This project is immediately across the Snake River from the Three Rivers Slope project hereinbefore described, and its transportation and marketing facilities are of the same excellence described for the latter project. Certainly this location at the confluence of two great rivers whose navigability is being constantly improved, and at the cross-roads of three great railroad systems, and embracing an area susceptible of high agricultural development, must be regarded as strategic and one that vouchsafes to that immediate district a future growth in population and industry probably beyond that of any other interior section of the state.

The soil is of the sandy loam variety of from 2 ft. to 8 ft. in depth and resting generally upon a rather porous underbody of sand and gravel, which makes for good drainage but does not tend toward a high duty of water. Upon the assumption that 40 per cent of the area would be devoted to fruit culture and that the canals would for the most part be concrete lined, I have fixed upon a delivery duty to the land of 33 in. and a pumping duty of 41.25 in. for an irrigation season extending from March 15 to October 15. The cost estimate for the project, omitting details, was made up as follows:

Pumping station complete.....	\$ 560,000
Pressure mains	65,000
Main canals and distribution systems.....	2,730,000
Engineering and contingencies.....	671,000
Total	\$4,026,000
Cost per acre for 80,000 irrigable acres.....	\$50.33

In connection with the above estimate it should be stated that I have considered but a single pumping station on the Columbia River with consequent long canals to cover all the land, whereas a detailed study of the project may prove that an additional pumping station at the extreme southeast corner of the project, on Snake River, would be a more economical arrangement. Attention should also be called to the fact that some canals may not require concrete lining as was assumed or that such lining could be deferred several years until actually required by the increasing area in cultivation. This would tend to reduce initial cost and thereby also the annual cost during the earlier years of development when the landowner is less able to meet these costs.

The board of engineers recently appointed by the Federal Government and the state of Washington to report upon the Palouse project, which embraces the identical area herein considered, estimated the cost of a gravity development with water supply from the Palouse River at from \$102 to \$123 per acre. Taking \$110 an acre as a basis for probable gravity cost, I have estimated that the annual cost for maintenance and operation, including interest, depreciation and taxes, would be \$13 per acre, or it would, in other words, be just above that estimated for the proposed pumping scheme. In addition to the lesser initial

investment required, a very distinct advantage in favor of the pumping scheme as compared with the gravity scheme is that the water supply is unlimited and that all complication as to water rights, power rights, interstate rights and uncertainty of storage efficiency would be wholly eliminated, all of which complications were adverted to by the board of engineers above mentioned and considered by them as possible sources of additional cost. In view of these facts I regard the pumping scheme not only as feasible but as superior to the alternative gravity scheme.

Priest Rapids Project.—This project is in the extreme southerly end of Grant County, Washington, and embraces that fine body of bench land included between the left shore of the Columbia River and the southerly slope of Saddle Mountain. It contemplates pumpage to elevation 900 ft. (M.S.L.) and the reclamation of 119,000 acres of irrigable land exclusive of the 7000 acres embraced in the project of the Haven irrigation Company, whose ditch line is at about elevation 460 ft. To reach the elevation first above named there is required a maximum lift of 430 ft. and a mean lift of 316 ft. from a pumping station located just above Priest Rapids on the Columbia River, in Sec. 15, T. 15 N., R. 23 E., W. M. The cost estimate for the project, omitting details is as follows:

Pumping station complete.....	\$1,065,000
Pressure mains.....	200,000
Main canals and distribution system.....	3,347,000
Engineering contingencies.....	922,000

Total

Cost per acre for 112,000 irrigable acres.....\$49.41

This project as above outlined must be considered in comparison with a direct hydraulic lift scheme, which may be developed by means of a power canal of large capacity heading on the Columbia River above Priest Rapids and carried down some ten miles to a point well below the rapids, where an effective head of some 60 ft. could be secured. A project of this character was reported on in 1906 and its cost estimated at \$85 per acre. It embraced lands to a maximum elevation of only 762 ft. and covered 104,600 acres of land, of which 11,200 acres came under a gravity canal on the west side of Columbia River and 34,900 under a gravity canal on the east side of the Columbia River. A maximum lift of 291 ft. and a mean lift of 131 ft. were contemplated in this development. No estimate has ever been made of the probable cost of a direct hydraulic lift plant contemplating the higher elevations proposed for the electric pumping scheme, and if the original figure of \$85 for the lower lift is correct it is probable that the cost of a similar plant, capable of reaching the higher elevations now contemplated, would be sufficiently high to make the proposed electric power pumping project the more economical.

(To be continued.)

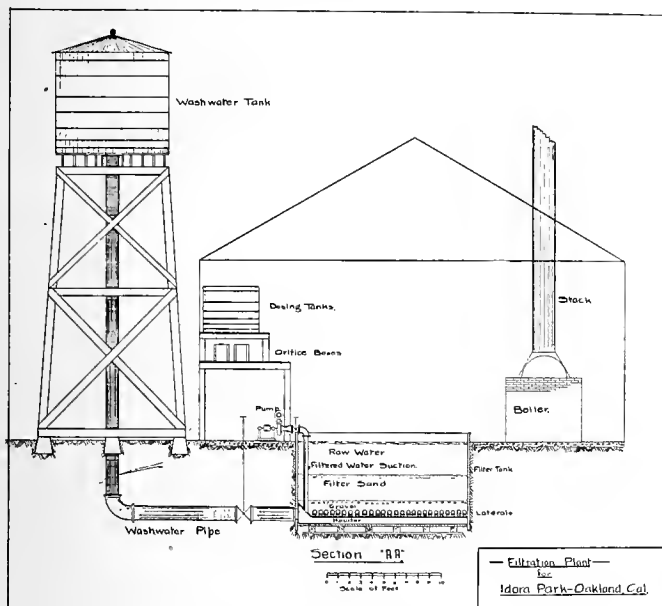
The area of canal rights of way generally varies from 1 to 2 per cent of the area irrigated. It is greatest where delivery is made to each farm on systems where the farms are small. Where the vegetation on the canal banks is kept under control either by seeding, mowing, cultivation or by other means, the manager of a system covering 50,000 acres will also be quite a farmer as the area in canal rights of way may vary from 500 to 1000 acres, of which one-half may be in canal banks,

FILTRATION PLANT AT IDORA PARK.

BY E. C. EATON.

Early in the present year the management of Idora Park, Oakland, Cal., decided to construct as an additional attraction for the Park, an open air swimming pool of 500,000 gallons capacity, having an over all length of 200 ft., width 75 ft., and maximum depth 9 ft. Owing to the distance, over three miles, to the nearest point from which the water could be pumped from San Francisco Bay, and the fact that water is available from underground sources within the park limits, a fresh water system was decided upon.

A filtration system having a capacity of half a million gallons daily has been put in, by means of which the entire content of the pool is filtered and treated daily, and in addition it is intended to add fresh water continuously at the rate of 15 per cent, making one complete change of water a week, in addition to the continuous filtration daily.



Plan of Filter Plant.

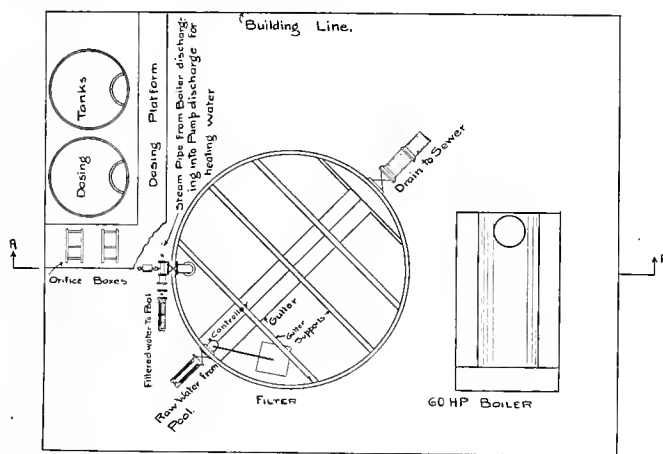
Filtration Plant.

The filter is of the rapid sand, gravity type, especially designed for the requirements. The gravity type was chosen as best meeting requirements for removal of lint and foreign particles, and accessibility, giving at all times a clear indication as to whether the proper blanket or floc is being formed and the washing carried out efficiently.

The plant is about 200 ft. from the swimming pool where the ground surface is about 5 ft. lower than the normal water surface in the pool. To enable the full 5 ft. head to be available for a gravity raw water supply, the filter tank, consisting of a redwood tank 15 ft. diam., 8 ft. high of 3 in. staves and bottom, was set on sills and chime joists, in an excavation, so that the upper edge of the tank is 9 in. above ground and the normal water surface in the filter is at approximately the ground level.

The $\frac{5}{8}$ in. bands on the tank were given several coats of asphaltum, applied hot, and the space around the tank backfilled with earth. In the bottom of the filter tank a header is run across the whole width of the filter. This header is of tapered section, each section being de-

signed to allow for the total quantity of water discharged into the header from the laterals with a minimum loss in friction, and an even increase in velocity from one end to the other. For the sake of economy this header was made of dressed lumber fastened to the bottom of the filter with iron straps and lags. After the header was in place, pressure was applied and the few small leaks well calked with wood. The header was designed so that the loss in friction head in each section is nearly made up for by the gain in velocity head, thus providing for an equal supply of water to each lateral during washing. In the top of the header wrought iron nipples are inserted connected to $3\frac{1}{2}$ in. tees, from which lateral pipes were run across the filter at right angles to the header. These laterals are spaced 6 in. centers and are of such a size that the loss in each hole is 2 ft. head during washing, at the required washwater rate. Over the laterals four layers of gravel are placed, tapering from large to small



Section of Filter Plant.

size from the bottom to the top, and over this is placed 27 in. of filter sand having an effective size of 36 m/m. and a uniformity coefficient of 1.91. The head of water over the sand is 37 in.

The raw water supply from the swimming pool is by gravity through an 8 in. wood stave pipe, and a constant head of water over the sand is maintained by means of a specially constructed float valve.

From the discharge end of the filter header a 6 in. suction pipe is brought to a 4 in. centrifugal pump returning the filtered water through a 6 in. wood pipe line to the swimming pool. All supply and discharge pipe lines between filter and pool are wire-wound wood stave with the exception of the drain carrying the washwater to the sewer, which is ironstone pipe. The rate of filtration is regulated by means of the discharge valve on the pump, keeping the flow at a constant rate, as shown by a Pitot tube in the discharge line.

Washwater System.

No mechanical rakes or air wash are employed, these being replaced by using a high velocity washwater system, in which washwater at a high rate passes through the laterals, up through the sand, and is caught by a V-shaped wood gutter connecting with the sewer. The water for washing is supplied from a wood tank elevated on a trestle, from which a wood

stave pipe is run to one end of the filter header and the flow controlled by a gate valve. The tank is supplied from the local water supply derived from wells in the park. The sand is washed when the loss of head in the sand reaches 8 ft., the depth of the filter tank. A bacteriological analysis of the filtered water when the pool had been in use 7 days, gave a count of 5 per c.c.

Coagulant.

Aluminum sulphate is employed as a coagulant to produce the floc blanket on the filter. A 500 gallon wood tank is mounted on a platform of such a height as to allow a gravity flow to the raw water pipeline. This tank is provided with a semi-circular compartment having a screen bottom in which the sulphate crystals are placed and dissolved by spraying water into this compartment by a distributor until a solution of the required strength is obtained. The solution is



Street Lighting at Vallejo, Cal.

drawn off from these tanks through a ball cock in an orifice box, by means of which a constant head is maintained over a $\frac{1}{4}$ in. orifice in the orifice box corresponding to the required dosing rate. From the orifice the solution is collected in a lead tunnel and runs to the raw water pipe line.

A liquid chlorine equipment manufactured by the Wallace & Tiernan Company has been ordered, and until its arrival the water is being treated with hypochlorite through an equipment similar to that employed for coagulant dosing.

A 60 h.p. horizontal tubular boiler is provided in the filter house, which maintains a constant temperature of 75 degrees in the swimming pool. No heater is employed, a jet of live steam being discharged into the discharge from the centrifugal pump.

The estimated costs of the various items comprising the plant are as follows, including engineering and supervision, the actual costs being somewhat less:

Filter:—Capacity 500,000 gal. per day.....	\$1,500.00
Coagulant dosing equipment.....	102.00
Heating boiler and piping.....	1,135.00
Pump and belt	165.00
Connecting pipe lines, sewer, raw water, washwater, etc	2,100.00
Washwater tank and trestle.....	450.00
Total	\$5,452.00

The plant was approved by Mr. Guy L. Bayley, consulting engineer, and designed and constructed by the writer.

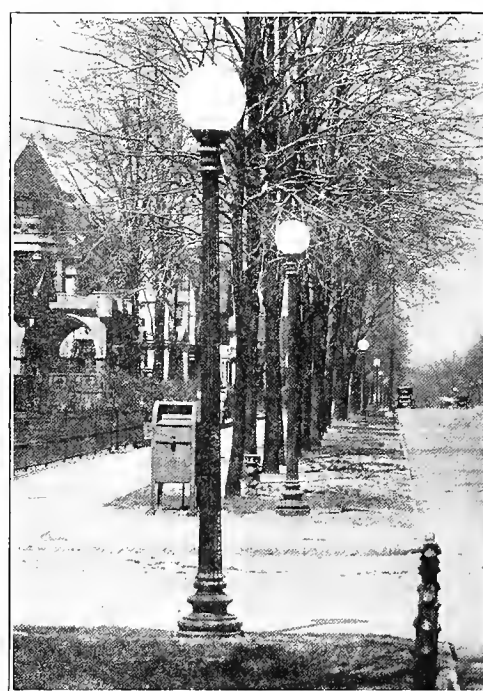
STREET LIGHTING.

BY WALDO C. COLE.

Street lighting can generally be considered under three classes: the business district, the residential district, and the outlying territory.

In the business district of a city, the illumination should be more or less brilliant, but not garish, as uniform as possible and of sufficient intensity to aid in preventing traffic congestion, to assist in avoiding automobiles, and to keep from tripping over projecting paving stones.

In residential districts, the intensity of illumination should not be as high as in the business districts, but it should be well diffused and just sufficient to allow consultation of a note book for any memorandum desired, and to distinguish house numbers. In fact, it should approach as near as possible what might



Lighting Standards in Residential District.

be termed the light from an artificial full moon on a clear night.

In the outlying territory, street lighting is primarily intended for a marker or guide, to direct the drivers of vehicles and keep them from straying into ditches and fences along the way.

The lighting of a city or town streets is a problem that requires considerable thought. It can readily be understood that a system cannot be selected by rule of thumb, but is only correctly selected after considering each of the many factors which are peculiar to the particular city or town.

To secure the desired results in a business district, units of large candle power rating, provided with globes that will free the light source from glare, are necessary. The spacing should be such as to produce a uniform illumination. On the other hand, residence districts should be provided with units of smaller candle power rating; in this case the spacing that will give uniform distribution is not easy to determine, because the general physical surroundings vary

through such wide ranges; for example, a street with small yards and few shade trees may change in a few blocks to one with deep yards and shade trees. These changes in physical surroundings may mean that globes of different material may have to be used in order that the one essential of prime importance in residential street lighting be had, a soft, well diffused light.

The outlying territory needs less careful consideration.

The fixtures cannot be chosen at random, because pedestals or poles that are ungainly, or not in their proper environment, will detract during the daytime from the general pleasing appearance of a city street.

There is one fundamental point that should never be forgotten in the selection of a street lighting system and at the same time, none of the other funda-



Street Lighting at Indianapolis.

mental points sacrificed. This one prime factor is that the greatest amount of light must be produced at the lowest consistent cost.

The new street lighting system of Indianapolis represents one in which all of the factors essential for the successful illumination of a city's streets were considered. This system consists of a combination of alternating current series flame carbon arc lamps and gas filled incandescent lamps.

For the illumination of the down town streets and ordinary street crossings, 2632 ten-ampere Westinghouse series flame carbon arc lamps are used. These lamps are provided with carbons having a guaranteed life of 100 hours, the light produced being white and approximating daylight. The inner globe is clear, while the outer globe, in order to eliminate the glare

of the light source and produce a well diffused light, is slightly opalescent. The lamps are mounted on ornamental metal poles, the ropes for lowering these lamps are run through each pole and not on the outside, thus in no way detracting from their appearance. To insure safety when trimming and inspecting a lamp, each is provided with an automatic Cutter cutout.

Incandescent nitrogen filled lamps used in the residential districts and for park lighting, are mounted on cast iron columns. The units vary in rating, depending upon the local conditions, from 150 to 400 candle power. They are all of the 10 ampere current type. In order to secure the soft, diffused light, so desirable with residential street lighting, each lamp is enclosed in an Alba globe; in the parks, drives and boulevards, Monax globes are used.

The successful combination of the two types of illuminating units was made possible by the selection of regulating transformers designed especially for this class of service. The ability to operate the two types of illuminating units on the same circuit has allowed the city of Indianapolis to provide the illumination best suited to each district without having to provide a system of many complications.

Another interesting installation is that of the Vallejo, Electric Light & Power Company at Vallejo, Cal., where 15 ampere, 400 c.p. series Type C. Mazda lamps are suspended at street crossings by Luxolite fixtures.

Pacific Gas & Electric Company's annual report for the fiscal year ended December 31, 1915, is a most interesting document regarding utility development. During the past ten years the gross earnings have more than doubled, the gross income for 1915 being \$18,530,301.04. Of this amount, \$9,924,482 was derived from sales of electricity, and \$7,560,185 from the sale of gas, the remainder being due to operation of the Sacramento street railway system and sales of steam and water for irrigation and domestic purposes. The operating revenues of the electric department were derived as follows:

Commercial and residential business.....	\$4,486,451
State, county and municipal business.....	787,612
Sales of power—Agricultural industry.....	354,171
Sales of power—Mining industry.....	650,740
Sales of power—Transportation industry.....	870,326
Sales of power—Manufacturing industry.....	1,663,099
Sales of power—Other electric light and power corporations.....	306,059
Sales of power—Commercial and miscellaneous.....	513,450
Panama-Pacific International Exposition—Light and power.....	291,146
Temporary lighting and power.....	1,418

Total\$9,924,482

Since 1907 the revenue from electricity has increased 57 per cent, the number of consumers 203 per cent, and the amount of current generated and purchased has increased 80 per cent. Half of this power is hydroelectric. It is estimated that 65 per cent of the current generated is sold, the losses totalling 35 per cent. The ten hydroelectric plants in the system have an installed capacity of 122,400 h.p., and the four steam plants 109,517 h.p. The system load factor was 59.4 per cent, and the peak demand 187,051 h.p. There are 1544 miles of high tension transmission lines, 146 substations, 3836 miles of distribution lines, and 827 miles of underground conduit. The connected load in motors, appliances and lamps is 525,541 h.p. The total paid in wages during the year was \$5,198,000.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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The promotion of public utilities is a field to which an increasing number of engineers are devoting their talents. The engineer possesses many of the qualifications requisite for a successful promoter and can do much to raise the standards of

a business that has sometimes fallen into disrepute because of the actions of a few scoundrels. Contrary to popular opinion, the Rufus Wallingford type is no longer a success as a promoter. Glittering generalities do not appeal to the man who has money to invest. He has learned to place his reliance only on a keen analysis based upon careful investigation by an expert in whom he can repose confidence.

As all public utilities are essentially engineering enterprises an engineer should be able to make a more intelligent investigation and analysis of the feasibility of a project than a general promoter or a lawyer. His knowledge enables him to discern the possibilities of utility development in new fields, his experience makes it possible for him to formulate the advantages to be derived, and his reputation inspires confidence in the mind of the investor.

Opportunities for new electric light and power plants, telephone, street railway, gas and water companies become scarcer every year. It requires good judgment to recognize the possibilities and probabilities. The best opportunities are not found fortuitously nor by those who hunt for them assiduously. An intimate acquaintance with both the field and the kind of service to be rendered is necessary.

Likewise in capitalizing the opportunity, the engineer promoter can draw on a fund of information as to cost data and probable earnings that the ordinary promoter seldom possesses. Even when no new developments are feasible he can see the economies that may be effected by consolidation of existing utilities. These savings include not only the elimination of wasteful competition, but also the advantage of more continuous duty for expensive machinery and expert technical staffs. He is familiar with valuation and can formulate an equitable basis for consolidation of smaller plants.

Engineering experience is equally useful in determining possible failures. When a plan receives the endorsement of a conservative engineer it carries far more weight than from an over sanguine promoter who does not realize the practical difficulties to be overcome. Not only are costs, earnings and profits to be taken into consideration, but also such matters as franchises, rights of way and the attitude of regulating commissions, with all of which an engineer is necessarily familiar.

An engineer, also, is better able to take care of the preliminary surveys and construction which must be undertaken before capital will seriously consider a proposition. In recent years most engineers have become familiar with financial matters and under-

stand the several kinds of securities, bonds, preferred stocks and common stocks, which are needed in temporary and permanent financing.

Such services are deservedly profitable. The task is an exacting one, it requires good judgment, great skill and much time. Constructive work of this kind is difficult and requires men of exceptional ability. Consequently it is remunerative and well worth the attention of any engineer who feels the limitations of work of a strictly technical character.

Integrity, uprightness of character, is the first essential of personal efficiency. As a public service corporation is but a person magnified, integrity may likewise be regarded as the fundamental requirement for corporate efficiency. An examination of corporate character through the lense of individual character reveals ways for enhancing corporate integrity.

Integrity in the individual is made manifest by a clean, straight, dependable life,—conformity to the moral law. A man's character differs from his nature in that it includes acquired traits. Upright character can be gained by effort. It is a by-product of always doing the nearest duty well,—faithfulness in the discharge of an obligation. It has been aptly defined as what a person is as distinguished from what he is supposed to be.

Character is an active force which, like a spinning top, maintains its uprightness by virtue of its movement. Like a gyroscope, its very motion imparts stability. A person of integrity is not easily displaced. The sense of positive resistance suggested by a man of strong character is similar to the mass of a physical body which physicists believe is due to the rapid motion of its constituent electrons.

The work accomplished by this force of character is confidence. That a man have ability is not sufficient. To be successful he should also have the power to compel men to trust his ability. This power is uprightness of character, integrity.

What has been said regarding integrity in the individual applies as well to the public service corporation, which has recently acquired a soul susceptible to moral training and consequently to character building. The corporation was first found to have a soul when courts placed the responsibility for corporate acts upon corporate owners. No longer is it possible to enjoy corporation privileges without assuming corporation responsibilities. Every right has its duty. The one is forfeited when the other is evaded.

Consequently the corporation is being made to conform to the moral law, to lead a clean, straight, honest and dependable life. Corporate character is measured by faithfulness in the discharge of its obligation to serve. Just as a people judge a man by his character, so does the public judge the corporation.

Corporate character, like its outgrowth, public confidence, is a plant of slow growth. It is based upon

years of honest, courteous and reliable service. Yet unlike its private counterpart, corporate reputation lags but slightly behind corporate character, which invariably becomes known to the public served.

Character is the framework of business, which is action based on the belief that the other fellow will do as he agrees. The Morris plan of loans prefers character to tangible security as the basis for credit. Stronger than a contract, more effective than courts, is strength of character in enhancing individual or corporate wholeness or soundness—integrity.

One immediate result of the recent decision establishing the legality of the Oregon water code is a conference which has been held at Tacoma during the past week to prepare a similar code for Washington. Governor Lister called together a number of representative engineers, hydro-electric men, irrigationists and business men to discuss legislation which is to be submitted to the legislature for enactment.

As has already been pointed out in these columns, the Oregon code, with its provisions for the adjudication of water rights and its preferential provisions for water appropriation, forms an excellent model for other Western states. The continued prosperity of this territory is dependent upon the greater utilization of its water resources. Irrigation and power developments are closely inter-related and in turn form the basis for advance in all lines of trade and commerce.

Why does an electrical contractor invest a thousand dollars or twenty thousand dollars in supplies and equipment and then work himself down to white hair and a five-cent cigar just for the honor of paying rent and being called a contractor?

Why doesn't he charge a profitable price for his work so that his payroll may be met with a smile, his jobber seek his business and his banker welcome his goings out and his comings in? Because he doesn't know his costs. Isn't that the reason?

Just because some competitor foolishly bids too low is a mighty poor reason for bidding still lower in order to get a job. Is it not better to lose a job which a cost system shows to be unprofitable, than to do the wild guess act, get it, and lose the profit on two other good jobs?

The man who gets the losing contract is not the only loser. He also robs the man who charges a fair, honest and just price based on a knowledge of costs. He befogs the minds of the architect and owner, putting money into their pockets and taking it out of the industry where it legitimately belongs.

Why not put a stop to this foolishness. Let the contractor admit "a loss there was" but make up his mind that in the future a profit there'll be, not only for himself but for the other fellow.

Enhancing Corporate Integrity

The Washington Water Code

"A Loss There Was"

PERSONALS

R. Tomlinson, an electrical contractor of Portland, Ore., is at San Francisco.

A. E. Arbogast, an electrical contractor of Los Angeles, is at San Francisco.

Wm. Bertrand of Bertrand Bros., Phoenix, Ariz., has been visiting San Francisco.

S. V. Waiton, commercial manager Pacific Gas & Electric Company, is at Marysville.

F. H. Leggett, Pacific Coast manager Western Electric Company, is at Los Angeles.

Harry S. Whiting, president of the Pierson-Roeding Company, is at the Yosemite Valley.

C. A. Stephenson of the Elko-Lamoille Power Company of Elko, Nevada, is at San Francisco.

J. C. Plankinton, manager of the Hilo Electric Light Company, is at San Francisco, en route to the Islands.

E. A. Chloepke, store manager of the Kimball Electric Company of Oakland, Cal., is in Mendocino county.

J. M. Saunders, secretary and treasurer of the Pierson-Roeding Company is at Los Angeles and San Diego.

W. S. Greenfield, Western manager of the H. W. Johns Manville Company, leaves for Los Angeles next week.

H. F. Hoiland, Pacific Coast manager Simplex Electric Company, has returned to Los Angeles from San Francisco.

T. W. Simpson, Pacific Coast manager Federal Sign System (Electric) has returned to San Francisco from San Diego.

C. J. Wilson, assistant engineer electric distribution Pacific Gas & Electric Company, is visiting Yosemite Valley by auto.

Howard Aylsworth of the Aylsworth Agencies Company, has returned to San Francisco from an extended business trip throughout the East.

H. F. Hartzel, manager for the Baker-Joslyn Company of San Francisco, has been visiting that company's Los Angeles branch for the past week.

W. B. Lewis and **W. Todd**, salesmen for the Western Electric Company, have just returned from successful trips through Northern California.

J. W. Woods, manager of the Pacific Coast Specialties Company, Oakland, has just returned from a four weeks' auto trip through Southern California.

S. P. Russell of the H. W. Johns Manville Company has mustered 34 men from his company to march in the Preparedness Parade at San Francisco on July 22.

T. H. Dooling of the San Francisco office of the Electric Storage Battery Company, is at Nogales, Ariz., with Company B, Signal Corps, National Guard of California.

C. A. Rylander, formerly with the Western Electric Company of Seattle, is now office correspondent for the Electric Railway & Manufacturers' Supply Company at San Francisco.

Warren Murray, chief engineer of the Western Sugar Refining Company, has returned from the East, where he purchased electrical and steam turbine outfit for the extension of their plant.

F. A. Wood, Pacific Coast agent Gamewell Fire Alarm System is at Salt Lake City. **A. F. Brown**, salesman for the Gamewell Company has completed a trip through the Montana territory.

Barry Dibble has been appointed project manager of the Minidoka Project (Idaho) of the U. S. Reclamation Service with offices at Rupert, Idaho. Mr. Dibble will continue to act as electrical engineer for this project.

E. O. Shreve, local manager of the Apparatus Department of the General Electric Company, has returned to San Francisco from the East, where he has been visiting the various factories of the General Electric Company.

J. D. Grant, president of the California-Oregon Power Company; **J. D. McKee**, vice-president, and **Paul B. McKee**, assistant to the president, all of San Francisco, were recently in Siskiyou County on a tour of inspection of the big dam that company is now constructing at Copco, on the Klamath River.

Elmer Dover of Tacoma has not been succeeded as president of the Oregon Power Company by **James A. Green**, as was erroneously stated recently. Mr. Dover retains the position as well as the general managership of the Byllesby interests in the Northwest. Mr. Green has resigned as vice-president of the Northern Idaho & Montana Power Company, and his successor will be selected by Mr. Dover as general assistant.

OBITUARY.

J. Harry Pieper, assistant to general manager of the Southern California Edison Company, Comus of fourteenth congress and congressman of the thirteenth district of the Jovian Order, died of heart disease at his home in Los Angeles, July 11, 1916. Mr. Pieper was ex-president of the Los Angeles Ad Club and Los Angeles Jovian League, a prominent member of the Knights of Columbus, Elks, Jonathan Club and Los Angeles Athletic Club, and his demise will be deeply felt by his hosts of friends among the members of many organizations with which he was affiliated. Mr. Pieper started his career in the electrical business in Boston, coming to California about ten years ago, and since that time has been in the employ of the Southern California Edison Company. He was forty-seven years old, and leaves a widow to mourn his loss. **W. A. Breckenridge**, vice-president and general manager of the Southern California Edison Company, said: "Through the death of Mr. Pieper the Southern California Edison Company and the community has lost a progressive and constructive employee and citizen."

MEETING NOTICES.

Oregon Society of Engineers.

The regular mid-summer meeting of the Oregon Society of Engineers was held at a dinner in the Oregon Building, Portland, Thursday evening, July 6th. After the dinner, Rural Credits, Drainage and Irrigation were discussed. President **W. S. Turner** acted as chairman. The secretary read two sections of the constitution which had been found unsatisfactory, and after a discussion it was decided to submit the change to the society for its vote on same. The sections related to the election of new members and honorary members.

E. G. Hopson opened the discussion and said in part: "There is an absolute need for drainage on every irrigation project. He cited one project in Nevada containing 50,000 to 100,000 acres of arid land lying below sea level, where drainage with open ditches 3 to 4 ft. deep was a failure, because the ditches were too shallow, soon becoming clogged with vegetation. An experimental drain 8 to 10 ft. deep, with 12 to 16 in. tile in bottom, was more successful, and lowered the water table for about 1000 ft. on each side. These drains with wooden manholes every 80 ft. cost about \$20 per acre drained. Wide, open ditches have been found to be better and can be installed for one-fifth the cost. They have been used successfully on the Truckee-Carson project. On the Malheur project in Oregon, open ditches 6 to 8 ft. and spaced from 330 to 660 ft. apart, have reclaimed land in three years. Theoretically, there is no need of a drainage system on irrigation projects, but the farmers always demand excessive quantities of water at the beginning of irrigation and to get rid of this excess it is always necessary to provide a drainage system. Some portions of a district is usually lower than others and drainage is necessary to keep the water down in these sections."

Mr. Graves told next of his experience in reclaiming alkali lands in the San Luis Valley, Colorado. He stated that in most government projects there is today about 70 to 80 per cent of waste lands due to lack of drainage. He also said that sugar beets would thrive on most alkali lands under proper cultivation and would help to get the alkali out of it. Engineers generally forget all about the drainage system and therefore figure cost too low.

J. P. Newell gave a short talk on the Jones bill. He fears that it is not practical, and the great temptation for the government engineers to protect their own reputation will have a tendency to cause them to report unfavorably on new projects. The Interior Department at present has no fund available for the work and has no disposition to hurry matters. Furthermore, it will tend to kill all private projects, as all investors will want only guaranteed projects. He thinks it better for the states to handle the guarantee and get quick action, even if there are mistakes made, than to have indefinite delays caused by the U. S. Government system of guarantee. Mr. Broili thought the government would be no more particular with these projects than with their own reclamation projects which were not all successes. Mr. Newell felt that the government would be more likely to recommend a project under its own control and direction than one under the control of someone else. Mr. Hopson did not fear delay. He said that all government projects were a success as far as the government was concerned, but measured as private investments they were not as the returns were delayed for many years, and maybe to another generation. Mr. Graves also endorsed Mr. Hopson's remarks. Mr. Cunningham felt political influences would affect state guarantees more than federal. Mr. Turner asked why cannot district irrigation projects be financed now, under the Oregon law? If the present law is defective, should not the Oregon Society of Engineers make it their business to see that it is amended to make it more attractive to investors. The discussion was then closed.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has issued a supplemental order approving stipulation filed by the Pacific Gas & Electric Company in which it agrees to set aside \$7,000,000 out of income during the next seven years for conservation of its assets and protection of stockholders and bondholders. The funds so set aside are to remain uncanceled. It is provided that the company shall have the right to apply against the above payments, payments made into sinking funds for each of the years above named.

The Great Western Power Company has filed an application with the commission for authority to sell \$277,000 first mortgage 5 per cent 40-year bonds. The money is to be used in reimbursing its treasury for additions and improvements heretofore constructed.

The Corcoran Water & Gas Company, Corcoran, Kings County, has applied to the commission for authority to issue \$10,000 6 per cent bonds, for the purpose of enlarging and improving its water system.

The Western States Gas & Electric Company has filed a supplemental application with the commission, asking its approval of a statement of expenditures made for extensions, etc., during May, amounting to \$14,008.50. Under the company's trust deed it is entitled to receive from the trustee 75 per cent of the above sum on account of cash deposited with the trustee against which bonds have been issued.

The Oro Electric Corporation and its subsidiaries have applied for permission to sell and transfer all their properties to the Pacific Gas & Electric Company, which is to pay \$1,491,151.35 for the properties. To meet the payment, the Pacific Gas & Electric Company wishes for authority to sell sufficient general and refunding mortgage gold bonds at not

less than 85. The Oro Electric Corporation gives as it reasons for selling that it is without sufficient funds to develop its properties properly and to complete its hydroelectric projects on Yellow Creek and Mill Creek, the estimated cost of which, when completed, is \$8,000,000, and will produce 130,000 h.p. of hydroelectric energy. The Pacific Company says it is desirous of acquiring reserve water power, and it believes it will be able to complete the Yellow and Mill Creek projects. The agreement for the merger was entered into last January.

NEWS OF THE OREGON PUBLIC SERVICE COMMISSION.

The commission has found \$13,702 as the reproduction cost new, less depreciation, of the Clatskanie Light & Power Company of Clatskanie, Oregon, and, as the present rates are below those generally found for furnishing like service under comparable conditions and as they do not yield the necessary operating expenses, depreciation and taxes, has ordered a slight increase in accordance with the following schedule: Residence lighting—First 15 kw.-hr. used per month, 12c per kw.-hr.; next 15 kw.-hr. used per month, 10c per kw.-hr.; all over 30 kw.-hr. used per month, 6c per kw.-hr.; minimum monthly charge, \$1. Commercial lighting—First 30 kw.-hr. used per month per kw. connected, 12c per kw.-hr.; next 30 kw.-hr. used per month per kw. connected, 10c per kw.-hr.; all over 60 kw.-hr. used per month per kw. connected, 6c per kw.-hr.; minimum monthly charge, \$1 per kw. connected, no minimum less than \$1; No connected load considered less than 500 watts.

COMPARATIVE COST OF WIRING.

A recent booklet issued by the Society for Electrical Development gives the following figures for the comparative costs of wiring. Owing to varied costs of material and labor, as well as different restrictions required by authorities at different points, the table gives only comparative figures:

Knob and tube.....	\$1.50 to \$2.50
Flexible steel and armored conductors.....	2.00 to 5.00
Flexible steel conduit.....	3.50 to 5.50
Rigid metallic conduit.....	4.00 to 7.00

TRADE NOTES.

The H. B. Squires Company of San Francisco will represent the Alphaduct Company, having purchased from the Aylsworth Agencies Company their rights for the Pacific Coast.

Kimball Electric Company has recently taken a contract with the California Central Creameries Company at El Centro. This installation included a 270 h.p. General Electric motor and all the wiring for telephone and lighting system.

The Pacific Coast Specialties Company of Oakland has recently sold out its Los Angeles branch and will now be known as the W. C. Bailless Company. This branch covered sub-branches at Santa Barbara, at Anaheim, Long Beach and Pasadena. This company's branches will cover Fresno, Sacramento and Oakland. In Fresno they are selling out the electrical line only.

NEW CATALOGUES.

Bulletin No. 49103, from the General Electric Company, describes jacketless and the water jacketed Glue Pots.

Westinghouse Electric Ranges are attractively portrayed in Catalogue 8-D from Westinghouse Electric & Manufacturing Company.

Bulletin 48906 from Sprague Electric Works of General Electric Company, illustrates and describes Type S-1 Electric Hoists of ½ and 1 ton capacity.



NEWS NOTES



INCORPORATIONS.

BOISE, IDAHO.—Shelley Light & Power Company, \$100,000, by J. F. Shelley, T. W. Shelley, Thos. Mitchell et al, all of Shelley.

ILLUMINATION.

TOMBSTONE, ARIZ.—An ordinance has been passed granting to Edgar L. Wright a franchise to construct and operate an electric light and power plant in this city.

IDAHO FALLS, IDAHO.—Messrs. Wilcox & Doyle, having secured 400 applications for the use of gas will begin the work of building the plant and laying the mains at once.

SNOWFLAKE, ARIZ.—Harry Steels, an electrician of Holbrook, was in Snowflake recently trying to interest the people in an electric light plant which he proposes to install here.

WATTS, CAL.—The council has signified its intention of improving Melvin avenue from the south line of Shorb avenue to the north line of Main street by the construction of ornamental electroliers on each side of the street.

LOS ANGELES, CAL.—The city council has adopted ordinances for the installation of a lighting system for lighting Adams street, between Figueroa and Hoover and Adams between G and Figueroa, and certain other streets.

SPOKANE, WASH.—Plans and estimates for the Main avenue ornamental curb lighting system have been filed with Commissioner Fassett by Chief Assistant City Engineer A. D. Butler. The estimate covers the installation and electric current for ten years.

LAGUNA BEACH, CAL.—Formation of a lighting district to comprise the principal subdivisions of Laguna is being considered. Circulation of petitions to be presented to the board of supervisors has been started for formation of such a district. It is proposed to light the principal thoroughfare from Arch Beach to McKnight's subdivision, with at least one additional street in each subdivision lighted.

TRANSPORTATION.

IDAHO FALLS, IDAHO.—It is now up to the city of Pocatello to grant a franchise for the electric road, and if this franchise is granted there is reason to believe that Pocatello will be made the division point between Salt Lake and Yellowstone, with a complete railway system for the city.

PORT TOWNSEND, WASH.—Engineers have finished a survey of the Port Townsend & Puget Sound Railroad, with a view to ascertaining the exact amount of steel required to replace the rails which have been in service. About 27¼ miles of track must be laid, and it is believed that the ties will have to be replaced.

WHITTIER, CAL.—Application has been made to the Board of Trustees of Whittier for a franchise to construct and for a period of 50 years to maintain an electric railroad on Philadelphia street and other streets. It is proposed to grant to the highest bidder a franchise on terms and conditions set forth in an ordinance granting the franchise. Sealed bids will received up to July 31st.

TELEPHONE AND TELEGRAPH.

DOWNEVILLE, CAL.—The Pacific Telephone & Telegraph Company has decided to put an entire new line between Sierra City and Sierraville over the summit.

SPOKANE, WASH.—Improvements and general construction work on the Inland division of the Pacific Telephone & Telegraph Company and Spokane work of the Home Telephone Company, aggregating \$51,420 were announced by C. E. Hickman, division commercial superintendent and general manager.

TROUTLAKE, WASH.—A telephone line will be constructed in Columbia forest by the forest service this season from Dead Horse Ranger station to Twin Buttes. The line will be 36 miles long.

SAN BERNARDINO, CAL.—Although the present franchise still runs for another year, the Pacific Telephone Company will shortly apply for a new franchise. A fight is expected over the dual phone system here.

FLORENCE, ARIZ.—E. Anderson, representing the Mountain States Telegraph & Telephone Company, reports that the company has completed arrangements for extending the phone line five miles up the river on the north side to a point where the river will be crossed and the line brought into town along the south side. The new arrangement will bring in new phone users on both sides of the river.

BERKELEY, CAL.—President Max Thelan and Commissioner E. J. Gordon of the State Railroad Commission conducted an inquiry into the rate and a proposed new basis of rates for the Pacific Telephone & Telegraph Company's service in the east bay cities at the Berkeley City Hall last week. The company's proposed readjustment of rates includes the establishment of a measured service for residence and business telephones. Further hearings will be held.

PORTLAND, ORE.—By unanimous vote the city council has passed one ordinance prohibiting the construction of any additional overhead poles and wires on the main streets of the Central East Side after June 1, 1917, and another ordinance requiring the removal of the present poles and wires by the end of 1919. The measure originally took in the entire Central East Side. As passed it takes in only the principal streets, including Union and Grand avenues and Hawthorne avenue and parallel streets north to Irving, between Third and Sixth streets.

TRANSMISSION.

REDDING, CAL.—A carload of electrical machinery for the Western States Gas & Electric Company, has arrived in Redding to be hauled by teams to the company's power plant near Junction City, Trinity county.

PRESCOTT, ARIZ.—G. B. Heller, engineer in charge of the projected Burro Creek electric power plant of Col. E. P. Thayer has gone to the site of the works, to install a water gauge system, the first move towards construction.

SPOKANE, WASH.—Engineers who have been figuring on power possibilities at the smelter site have reported that the river can be raised 80 ft. by a dam at the north end of the rocky gorge. The plan of power development is being considered by the Spokane Valley Power Company, which has applied to the council for a franchise.

IRRIGATION.

LAKEPORT, CAL.—Mary E. Jewell of Middletown applied for permission to appropriate 18 miners' inches of water of Gallagher Creek, for irrigation purposes.

MONTAGUE CAL.—A large tract in the vicinity of Granda will be put under irrigation as soon as water can be brought from the Shasta River through a pumping system.

VISALIA, CAL.—Superior Judge J. A. Allen has handed down his decision decreeing that the \$283,000 Alpaugh Irrigation District bonds, voted some time ago, are legal, thus eliminating any doubt that may have existed and permitting the bond-buyers to buy the bonds without fear of their validity. The court was asked for the opinion by a petition of the district itself. The money from the bonds will develop thousands of acres of land in the Alpaugh district and protect it from the steadily rising waters of Tulare Lake.

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Devoted to the Conversion, Transmission and Distribution of Energy

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PROGRESS UPON THE HETCH HETCHY PROJECT.

BY ROBERT SIBLEY.

HOW TO HANDLE THE DEALERS' PROBLEM.

BY M. L. SCOBEE.

PUMPS FOR IRRIGATION OF SMALL AREAS.

BY BARRY DIBBLE.

PROSPECTIVE MARKET FOR IRRIGATION
PUMPING.

BY JOSEPH JACOBS.

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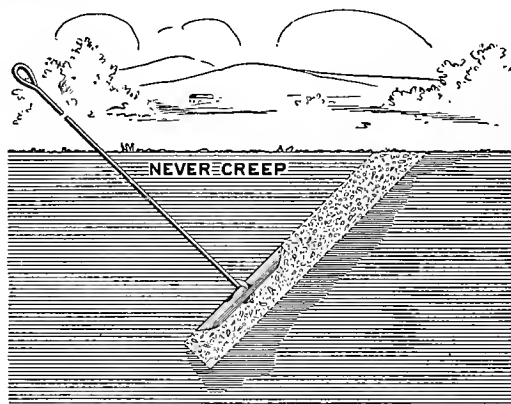
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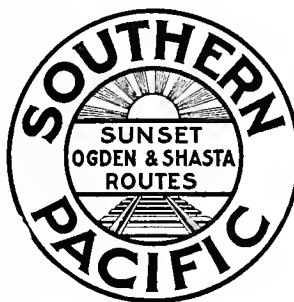
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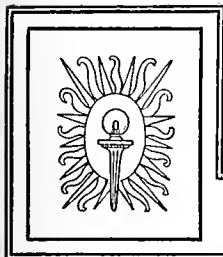


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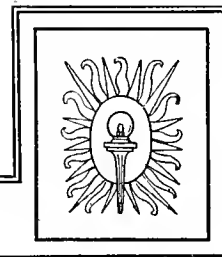
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PROGRESS UPON THE HETCH HETCHY PROJECT

BY ROBERT SIBLEY.

The Hetch Hetchy project has been conceived to supply the people of the San Francisco Bay region with pure mountain water from the Sierra Nevada Mountains. In its ambitious size and the daring it involves this represents perhaps the greatest project in the history of municipal undertakings.

Notwithstanding the ever-increasing developments by the Spring Valley Water Company, the citizens of San Francisco have long seen the ultimate

miles directly east of San Francisco. Immediately to the north of this valley is Lake Eleanor and its drainage basin, together with the Cherry River drainage area, both of which are to be included in the development scheme.

The principal reasons given for the adoption of this project are the lower cost of construction, the abundant water supply and a purer quality of water than any other obtainable.



Hetch Hetchy Valley Looking Through Proposed Damsite.

need for a far greater supply than can possibly be delivered by any local enterprise. So, for the last fifteen years the engineering force of the city has been scouring California for possible means of future water resources. A dozen different projects have been examined, and the one which has seemed most feasible to the city's engineers is the Hetch Hetchy development.

The Hetch Hetchy Valley of the Tuolumne River is situated in the Yosemite National Park, some 150

In May, 1908, a permit was obtained from governmental authorities to use Lake Eleanor as a site for a storage reservoir, with further permission to use the Hetch Hetchy Valley as a storage site when the limit of storage of Lake Eleanor had been reached. This permit was later called in question by the Department of the Interior at Washington, as two objections had been raised. The one was that prior rights to the waters were being jeopardized, and the other that

the natural beauty of a great scenic national park would be destroyed.

These contentions have led to endless hearings, and are even now not entirely settled, although the



Typical Railroad Bed Work Now Completed by City of San Francisco.

matter has been approved by Congress, and the "Raker Bill" was signed by President Wilson on December 19, 1913, enabling San Francisco to proceed with the work under certain definite conditions.

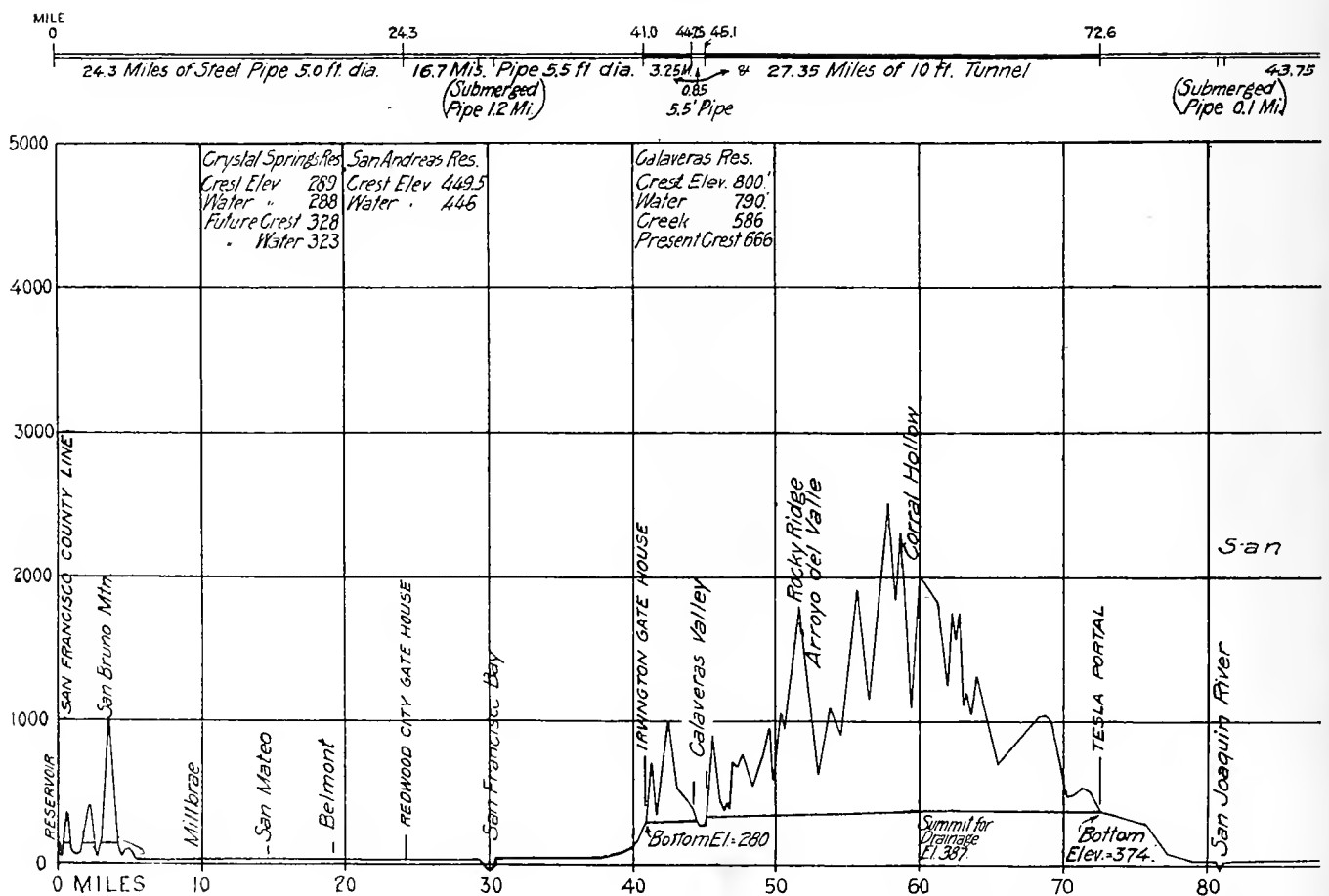
The present plan of development is based on a report by John R. Freeman, dated July 14, 1912, providing for an ultimate supply of 400,000,000 gallons per day from the Tuolumne watershed. No pumping

will be necessary, the tunnels making a gravity delivery possible. The Hetch Hetchy Valley will be utilized as the first reservoir site by means of a 350 ft. masonry dam placed in the narrow gorge at the lower end of the valley, which is to be flooded to an average depth of 270 ft. for a length of seven miles. The aqueduct in the initial development will consist of 88 miles of pipe 5 to 5½ ft. in diameter, and 66 miles of tunnels 10 to 10½ ft. in diameter, a total length of 154 miles to the county line of San Francisco. After the first 19 miles of aqueduct from Early Intake is completed, the water will be dropped 1300 ft. to an electric generating station at Moccasin Creek, where an average of 66,000 h.p. will be available. The tunnels will be in the Sierra Nevada and the Coast Range Mountains. The pipe will cross the San Joaquin Valley and extend from the tunnel outlet in the Coast Range to storage reservoirs. The San Joaquin River and the head of San Francisco Bay will be crossed by submerged siphons.

The cost of the first unit in the water development is estimated at approximately \$44,147,000. The final completion of the entire project for delivering 400,000,000 gallons daily to San Francisco Bay district will cost about \$77,000,000.

The Early Intake.

Eventually the water will be carried entirely in closed conduits, but for the present the first 12 miles of conduit down to the mouth of Cherry Creek will not be built. The water will be allowed to flow down the natural bed of the Tuolumne River to the Early Intake. At this point there will be built a temporary



Preliminary details have been worked out. A 70-mile railroad is being constructed into the valley and will probably be in complete operation by next summer. A scenic road 22 ft. in width, six miles long with crushed granite base is already built into the valley floor. The timber clearing of the main valley floor is about completed. The division tunnel, 15 ft. in diameter, driven through solid granite at the base of the damsite awaits only the blasting of a 15 ft. shelf at the lower water mark to be complete. In addition to this work certain development work is being conducted at the Early Intake, 12 miles below the proposed Hetch Hetchy dam. Until the completion



Proposed Dam as Marked on Rocks in Hetch Hetchy Valley.

of the railroad, which is being pushed with all reasonable haste, is accomplished, it is hardly to be expected that the work could at present be pushed any more energetically.

The directing of the entire Hetch Hetchy project is under the supervision of Mr. M. M. O'Shaughnessy, city engineer of San Francisco. The general contract for the city railroad that is being built into the valley has been let to Mr. F. Rolandi, who has Mr. C. H. Spinks as responsible field agent to supervise construction.

The estimated costs for the various units involved in the complete Hetch Hetchy scheme of development over the seven years allowed for construction are distributed as shown on the previous page.

HOW TO HANDLE THE DEALERS' PROBLEMS

BY M. L. SCOBEEY.

(This instructive account of effective sales methods was presented at the annual convention of the California Association of Electrical Contractors and Dealers, Stockton, Cal., June 15-17, 1916. The author is manager of the Hinc Electric Company at San Francisco.—The Editor.)

While the contracting business is by far the larger, it is no more important than the retail end of the electrical industry. I am sorry to have to admit that heretofore it has in reality been the end, or I might say the tail-end, of the industry; whereas it should be foremost. That is the goal that the dealers of San Francisco are working toward.

About two years ago the retail electric shop or store was simply a by-product of the contractor's business. During the past two years big improvements have been made, but there is still room for bettering our business and putting the retail electrical store at the head of the industry, where it really belongs.

In the larger cities the retailing of electrical devices is done mainly by the department and hardware stores as well as by druggists and grocers. It is this condition that we have to face and see if we can't reclaim the business and get it flowing in the proper, natural channels—namely, to the retail electrical dealer.

In order to correct this condition we have to find out where we have failed, and I'll tell you what in my opinion has been the trouble in the past, and what we should do in the future to put our business on a paying basis.

It is safe to assume that fully seven-eighths of the retail stores are operated by people or firms in the contracting business. The stores have been sadly neglected, with the consequence that the business has gradually drifted away, until now the stores outside of the electrical industry are disposing of from three to four times as many electrical devices as the electrical shops.

Window Dressing.

Statistics show that 80 per cent of the buying is done by women, and if we are to succeed, the first thing to do is to cater to the women. The first and best way to get the women's interest aroused is through our display windows. So in order to get started right give some time and thought to arranging your windows, and be sure that the windows are kept clean so they can see what is on display without straining their eyes. Don't try to put samples of everything you carry in the windows at the same time, because it only tends to confuse the prospective customer, and she passes on with no definite impression, while the value of your window is lost. Take one or two items and if necessary, put your entire stock of those items in the window. For instance, an attractive display can be made of a few curling irons with a hair-dryer or vibrator, and this, together with cards from the manufacturer or from the sign-painter, tells at a glance the price advantages of the article displayed, and the woman goes on her way impressed or imbued with the idea that the electrical way is a good way to take care of the hair.

An interesting window can always be made with flat-irons and perhaps a few No. 92 Benjamin Plugs,

showing how the ironing may be done and at the same time light may be had from the single socket ordinarily found in the kitchen.

Borrow some of your wife's best china and silver and use it for another display in connection with toasters, percolators, samovars, and chafing dishes, and just as soon as you begin to give the question some thought and study, you will be surprised to find the number of combinations that can be worked out; but don't, for your own sake, try to crowd your windows with a dozen different classes of goods.

Let's assume now that your windows are attractive enough to have the woman come in to buy a curling iron or some other device. What is she going to find when she gets inside the door? Will she have to pick up her skirts to step over some short lengths of conduit or molding left on the floor, or will she find the counter or showcase covered with dust or littered with condulet catalogs and papers to such an extent that she can hardly find a place to lay her purse while she investigates the article she is looking for? If she does, even though she may possibly make the purchase, chances are nine times out of ten that the next time will find her on the way to the department store instead of coming back as she should.

I have been in some stores with conditions even worse. I have seen journeymen's or shop tools on the counter or floor, or both. I have seen barrels on the store floor with straw scattered about. I have seen show cases where the dust has been so thick I could write my name on it. I have seen people behind the counter who did not seem to know what they had in stock or where it was kept, and sometimes after it was finally located they had to look up and find out the cost and then figure out what they should charge the customer.

I am not exaggerating conditions a bit, and I tell you that such things are distasteful to anybody, either man or woman; and that is one of the main reasons why our business has been getting away from us.

All this can be easily remedied at practically no expense whatever. An investment made in brooms, dusters, and a good chamois skin, together with a liberal amount of elbow grease is the solution. Try it out with your boy, and see how quickly you can wear these articles out. By the time they are ready to be replaced, you'll be willing to buy them by the dozen if need be.

Another important factor to be dealt with which I consider a vital one, is the illumination of our stores and places of business. Here we are in the electrical business, one of the main functions of which is to create light. We advocate light, we recommend to other merchants new lamps, new reflectors, all of which tend to attract people to their stores and increase their business, but what are we doing for ourselves, for our own lighting effects. We should set the example. Our windows and stores should be flooded with light. But are we doing it? Do your windows stand out as the best lighted in the city, and if not, why not?

This is very important, and in improving your own lighting you will be helping not only yourself, but the entire industry, besides obtaining and holding the respect that should be due our place in the business world.

True, you say that it costs money, and I grant you that, but I'll warrant that it will not increase your expense over \$5 per month; and even at \$5 per month, you couldn't find a better advertisement or one that will bring larger results.

Helpful Co-operation from all Quarters.

If there is any place in the United States for the electrical dealer, it is right here in California.

Perhaps you do not realize it, but we are working under better conditions here than in any other part of the country. We have the central stations and jobbers working, not only with us, but for us, because they realize that if our business is a success theirs is bound to be a bigger success.

Nowhere else in the country are the central stations maintaining such prices on lamps and current-consuming devices. Just stop a minute and think what it means. It's safe to say that 60 per cent of the dealers are paying their rent and even more, just on the profit from the sale of Mazda lamps, and where would we be or what chance would we stand if they saw fit to give free renewals, or sell lamps at their cost, which is below ours.

What could we do if they instituted campaigns on flat irons at \$2 each; or on toaster at \$1.75 each. It is being done elsewhere, but thank goodness, not practiced here, and it is up to the dealers of this association to turn to and show them that we appreciate what they are doing for us, by making our stores real places of business, making them attractive and not repulsive, and by carrying a representative stock so that consumers can get what they want, when they want it, and after they've got it, they'll go away knowing what they've purchased, what it will do, what it will not do, what it costs to operate, etc.

We also have to thank the jobbers for what they have done and what they are doing for our industry, for the time and money they have put in to start us on the right track. There was a time when the jobber would sell a bill of goods to a man putting up his own house or factory, but it's not the case now. Such inquiries are being turned over to the different members of this association, and it is that kind of co-operation that helps, and we should show our appreciation by supporting them, for by so doing we cannot help but increase our business and profits.

It is quite evident that the manufacturer is beginning to realize that there is such a person as the electrical dealer. Their attitude towards the dealers is quite different than it was a year or two ago, and today the manufacturers or their representatives are beginning to work with us through the jobber. They confer with us, they ask what we want, what we need, if the goods meet with public demand, and if we have any real grievances they are considered and generally remedied when we present them in the right way through the proper channels.

Just stop a minute and think what we have. They are all for us and none "agin" us, unless it be ourselves and our methods of doing business.

The Electric Range and Its Possibilities.

For the contractor-dealer, a big field has been opened by the development of the electric range. Here is an opportunity to get in on the ground floor and

keep this business to ourselves, but prompt and vigorous action must be taken, before the house-furnishing and department stores get started with the line.

In this instance we can get the start on our friends, the enemy, and by being first on the ground, the business will go to the contractor-dealer, and rightfully so, because you are the only ones who can both sell the range and make the installation, with a profit on both. The central stations are virtually handing this business to you on a silver platter, which, within a short time will undoubtedly be one of the main-stays of the contractor-dealer.

Get your sample range, connect it up, and then take steps to let the public know that you can not only sell them an electric range, but that you will make the installation without cost to them, which makes a pretty attractive proposition.

If the members of this association do not take advantage of this opening and get busy on the sale of ranges, the manufacturer and jobber will be forced to seek some other outlet, and if such a thing happens, we have only ourselves to blame.

The Importance of Stock Cards.

Another point I would like to bring out, because from my own experience, I believe it will be of great help to the electrical dealer, and that is the subject of stock card records.

Stock Card Records are not worth the cost of the paper if they are not kept up, but if it's worth while starting, it's worth while seeing that they are right up to the minute, and I'll tell you why. They keep down overstocks, because the cards show how much is on hand, and how much has been sold in 30, 60 or 90 days, and you can govern yourself accordingly when placing your orders.

In some instances your card records show where you can consistently increase your order on certain items and consequently get a better price, while on the other hand they show where it is to your advantage to cut down on some other item, because the turn-over is so slow that you are not justified in carrying that particular article in such large quantities.

Your cards also show from whom the goods may be purchased, what they cost and what they should be sold for, in order to return you a reasonable margin of profit on your investment. It gives you a perpetual inventory of your stock, and you will save much waste of time and labor that would otherwise be incurred if you did not use stock card records.

The Local Retailers' Association.

The San Francisco local of this association has a retailers' section, and before closing, I want to give a few instances of what we are doing for the good of the electrical industry, and perhaps an inkling of what we hope to accomplish.

We meet every Thursday night at 7:45 and adjourn at 9:00 p. m., and in that hour and a quarter take up and discuss problems and topics which we believe will benefit our retail business. Each one attending contributes ten cents each week to defray cost of postage, stationery, etc., so the expenses of the meetings are practically nil,

We talk over costs of the principal articles carried, their good or bad selling points, and in one or two instances we have found items where our gross profits on certain specialties was about 20 per cent, and we decided that the manufacturer could not reasonably expect us to exploit or even carry that specialty when the turn-over was so slow and the gross profit so small. We accordingly took the matter up with the jobbers and the result was that we are now enjoying a gross profit of 33 1/3 on that article, instead of 20 per cent, and we can now afford to carry it, and devote some time and window space to selling it, because the profit warrants our so doing.

We have adopted a schedule for the uniform dressing of our display windows. For instance, one week we all try to make a prominent display of flat-irons, then the next week flash-lights, and so on; and by doing this we believe that repetition or reiteration will make a deeper impression on the minds of the public when they see the same class of devices shown simultaneously on Market street, Polk street, Mission street, or wherever they happen to go.

We have started a co-operative plan of advertising our business, viz: the exclusive electric shop. We will make it a publicity campaign for the education of the public, endeavoring to show them that it is to their advantage to buy electric devices at an exclusive electrical shop, and that, as one of our dealers has said, they should not take their watch to a blacksmith to be repaired, but take it to a jeweler. They naturally would take it to a jeweler and we want to turn their thought, if possible, so that when they want a flat-iron or flashlight, that they will naturally patronize an electrical store instead of going to a department store or a drug store, where in a great number of instances, they will have inferior goods palmed off on them at cut prices, but which always prove more expensive in the long run.

As individuals, none of us feel that we could afford to start such a campaign, but we do feel that collectively and as members of the association we can not only afford it, but that good work can be done, and that results are bound to come of it.

Bear in mind, we are starting in on this in a small way, but we are starting, and we already have assurance of assistance from our San Francisco local and we are in hopes that we may receive more assistance from the jobbers, central stations and manufacturers who will naturally share in results from this campaign of education.

ROAD MACHINERY SUPERSEDES HAND LABOR.

Consul Homer Brett, at La Guaira, Venezuela, reports that the policy of the department of public works in its road building hitherto has been to use hand labor exclusively, so as to give employment to as many persons as possible; but recently a number of wheeled scrapers were bought in the United States, and after they had been tested officially it was announced that one man with a scraper accomplished the work of 20 men under the old methods.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

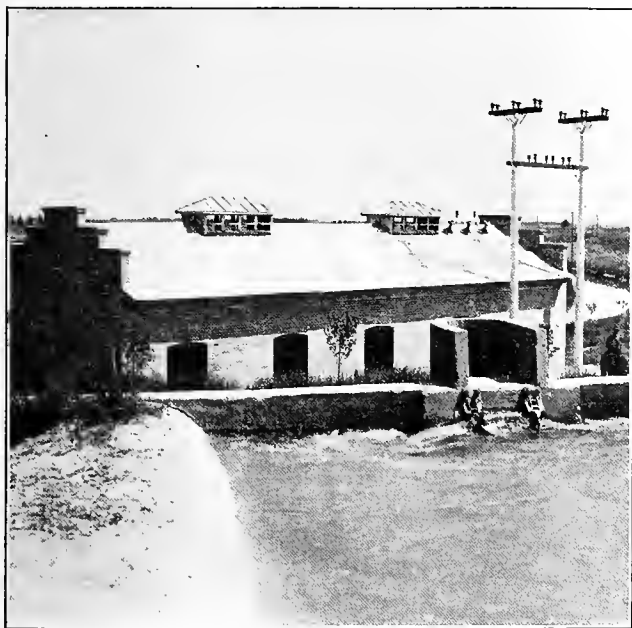
PUMPS FOR THE IRRIGATION OF SMALL AREAS.

BY BARRY DIBBLE.

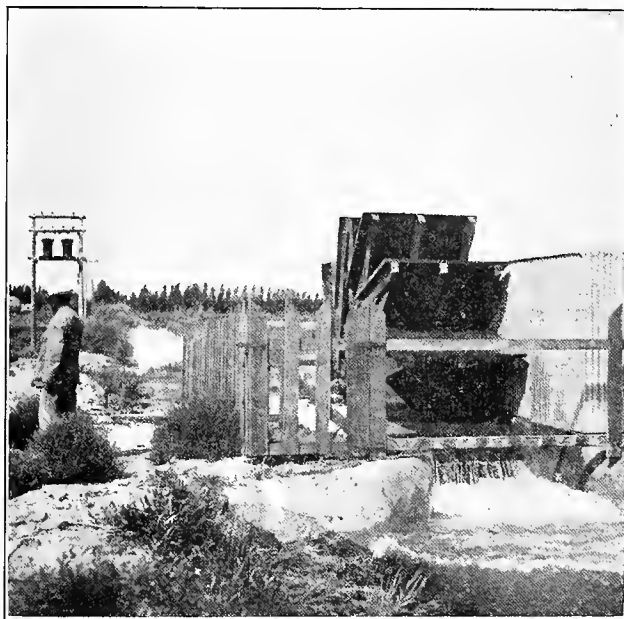
(The author of this article is the electrical engineer in charge of the Minidoka project of the U. S. Reclamation Service in Idaho. Besides the main pumping units on this system which supply the largest single irrigation pumping project now operating in the United States, there are a number of small installations. The author's extensive experience in both the construction and operation of these developments give him unusual qualifications for discussing the subject. The article was prepared as a talk before the irrigation operation and maintenance conference held in Boise, Feb. 1916.—The Editor.)

The most common type of pump for lifting irrigation water is the centrifugal. In principle this pump is extremely simple. It consists essentially of a revolving portion, or runner, into which water enters near the axis, and a casing or volute to catch the water leaving the runner and conduct it to the discharge pipe. The runner creates a velocity head in the water;

The correct speed of a pump for a given lift is the speed at which it will operate at the highest efficiency. Important losses in a pump are shock and skin friction. Skin friction is a function of the velocity of the water through the pump and of the shape of the vanes. It can be largely avoided by carefully smoothing the surfaces of all water passages in the pump. At the best speed water should pass from the suction to the runner and from the runner to the casing in a smooth stream with few eddy currents and little shock. If the speed is higher or lower the shock and the eddies in the water increase and therefore the efficiency decreases. This means that, while running a pump above the correct point will increase the quantity of water discharged, the amount of power required to drive the pump will increase in greater proportion. For this reason it is poor economy to install a small cheap pump and have to run it at high speed when a somewhat larger pump, run at its correct speed will



Typical Power Installation for Small Pumping Plant.



Current Wheel for Small Lifts.

in the casing the high velocity is reduced by a gradual increase in section and the velocity head is largely converted into pressure head.

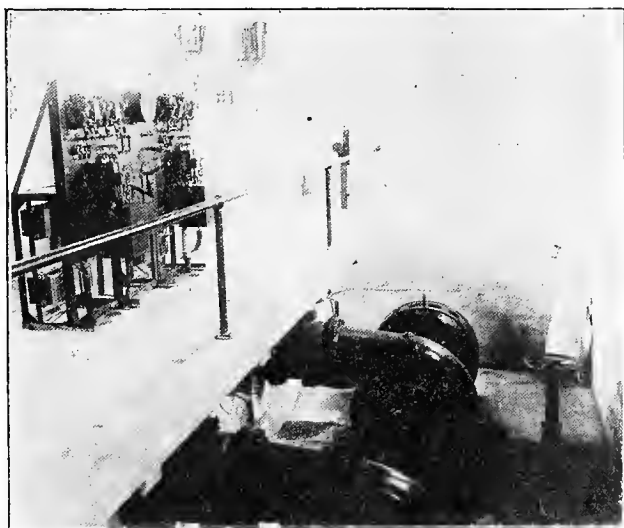
The runner, rotating at high speed, throws the water it contains to its outer circumference by the action of centrifugal force. The faster the runner turns the greater the energy put into the water. The correct speed for a pump runner is closely related to the head or lift that it is required to pump against. Ordinarily the peripheral speed should be about 1.20 or 1.25 times the spouting velocity ($V = \sqrt{2gh}$) corresponding to the head, although this rule is subject to some variation on account of changes the designer may make in the curvature of the runner blades. This may be illustrated in other words by assuming an increase in the head on a given pump to four times its original height. Doubling the pump speed will then restore the proper working conditions,

deliver the same amount of water with the expenditure of only a fraction of the power.

If the speed is maintained constant and the lift, or head, is varied, the quantity of water varies. The curve that represents the relationship between head and quantity of water is known as the characteristic of the pump. Each centrifugal pump has its own characteristic curve. The designer has wide latitude in determining this characteristic and on it depends the suitability of the pump for any particular installation. There is a tendency to regard a six inch centrifugal pump as a six inch pump and practically equivalent to any other centrifugal pump of the same size, particularly to any other of the same make. This is entirely wrong and leads to many mistakes and much dissatisfaction. Stock and second hand pumps are a dangerous purchase for this reason, unless their characteristics are known and understood. Especially for a

permanent installation the conditions under which the pump is to operate should be carefully determined and proper allowance made for indefinite factors, so that the type of characteristic best adapted to the work can be selected. The saving in power alone will usually pay many times over for care at this point.

The writer has in mind a case where it was intended to install a pump in a well or caisson sunk below the water plane. As in many such cases, the amount of the drawdown was indefinite, as also were the fluctuations to be expected in the water plane. It was expected that the average lift would be about 55 ft. The pump furnished by the manufacturers came up to the requirements of efficiency and capacity at this lift, but on test at the factory it was discovered



Electrical Equipment for Typical Pumping Plant.

that the characteristic of the pump was such that at 57 ft. the pump would not raise any water, while at 35 ft. the pump would throw a stream of water nearly double that required and would overload the motor some 50 per cent. Fortunately the specifications were such that rejection followed. After some experimenting the manufacturers developed a runner and volute that gave even better results at 55 ft. lift, and the pump, as redesigned, would deliver a gradually diminishing stream up to 90 ft. At no point on the curve was more power required than at the lift for which it was designed. This condition was ideal for the location. It gave a pump that was little affected by fluctuations in the water surface and avoided any danger of burning out the motor should the water plane rise.

Where the pumps are designed to lift water to great height, the velocity with which the water leaves the pump runner becomes quite high and in such cases fixed diffusion vanes are sometimes put between the runner and the casing to catch the water as it leaves the pump runner and turn it without undue shock, so that it will enter the volute in a smooth stream. Centrifugal pumps fitted with these diffusion vanes are sometimes known as turbine pumps. In principle they are the same as the commoner type.

Of recent years there has been a great improvement in the design of centrifugal pumps and high efficiencies are now obtainable. It must not be supposed, however, that these high efficiencies are in-

variably secured in purchasing apparatus of this sort. There are many opportunities for losses in a centrifugal pump and many of these losses may occur, if the pump is not properly selected for the work which it is to do, if the specifications or the design are not properly drawn and carried out, or if the pump is not properly maintained. Shock and skin friction have already been mentioned.

Another frequently serious loss is due to the leakage of air into the suction pipe or through the glands of the pump shaft, when the pump is placed above the level of the water to be pumped. Where the suction lift is comparatively great this can be a controlling factor and the air leakage, due to poor packing, may be so excessive that the pump will not lift the water to the height of the runner. To overcome this difficulty it is desirable to set the pump in such a way that there will be no suction lift, but the pump runner will at all times be submerged. This can be done by using pumps with vertical shaft, and setting the entire pump below the water surface of the intake so that it will be submerged even when the water has gone down to the lowest level. It sometimes happens that pumps can be set horizontally and still secure this result by placing the unit, or at least the motor or engine, in a sump which can be kept drained while the water is led to the intake of the pump under a slight pressure.

Where pumps are placed above the intake water level, it is necessary to make some provision for priming them. This means that either a foot valve must be placed on the suction pipe below the pump so that, before starting, the pipe and pump can be filled with water, or a tight valve of some sort must be placed above the pump and means provided to extract the air from the pump and pipe, so that the water will rise into the partial vacuum created. Either of these methods introduce complications and additional losses. The loss in a foot valve is rarely less than the equivalent of 4 ft. in head and the writer has known it to be as high as 15 to 20 ft. depending upon the design and size of the valve. A check valve in the discharge also introduces losses and either one is also liable to cause trouble from water hammer when it closes suddenly upon the stoppage of the pump. A gate valve in the discharge may be used for priming, as may also a common flap valve placed on the end of the discharge pipe. The gate valve is usually quite expensive. The flap valve has the disadvantage of being a long way from the pump, so that it is necessary to remove a large amount of air before sufficient vacuum is created to cause the water to raise to the pump. If there are any leaks in the pipe further difficulty ensues. In a long pipe without an air vent there is danger of collapse when the pump stops. All in all, it is much better, where possible, to use submerged pumps and avoid these complications.

It will be appreciated that, while with a high lift the loss due to the foot valve or other fittings may be but a slight portion of the total head and may not materially affect the efficiency of the installation, if the head is very low the losses in valves and bends may amount to more than the total static head against which it is desired to pump the water and the percentage of loss will be correspondingly great. Power is

usually an important item in the operating cost and reasonable care should be exercised to improve the efficiency of the plant, in order to cut down the amount of power which will be required.

The centrifugal pump is adapted to many kinds of drive. Where available at a reasonable price, electrical power is undoubtedly preferable. Motors which can be directly connected to the shafts of either vertical or horizontal pumps may be obtained. This has the advantage of eliminating trouble and loss from belt and gears. The operation of electric motors is extremely simple and they are readily handled by unskilled labor. With gas engine drive it is usually necessary to belt the engine to the pump, providing clutches on tight and loose pulleys so that the engine may be started without having to turn the pump at the same time. With steam engines there is the additional complication of the boiler plant and the need of constant attendance, but the steam engine is less likely than the gas engine to be the cause of profanity on a cold morning.

If water power is available at a drop in a canal or stream it is sometimes feasible to connect a water turbine to the shaft on which the centrifugal pump is mounted, and use the fall to raise a portion of the water to a higher level. This makes a simple combination and one which should run long periods with little attention.

I need not mention the current wheels, which have for many years been used along western rivers to raise water in buckets attached to the circumference of the wheel for the irrigation of small areas. The Reclamation Service has adapted the old fashioned water wheel to pumping in another way, in what is called a scoop wheel. This is merely a breast wheel operated in the reverse direction and driven by an electric motor or other source of power. These wheels must, for best results, have a peripheral velocity of only 3 or 4 ft. per second and it is therefore necessary to reduce the revolutions per minute from the motor to the wheel by large gears. The wheel carries paddles, which fit closely as they turn against the smooth concrete surfaces of the foundation. They dip into the water of the intake and raise it between the concrete walls discharging it breast high. The diameter of these wheels should be at least three times the height through which the water is to be lifted, and therefore the size becomes prohibitive above moderate lifts. However, this type of pump has a place for lifts of from 1 or 2 to 5 or 6 ft. High efficiencies are obtained. The wheels at present in service show a plant efficiency, including all motor and gear losses, of about 70 per cent. A 15 ft. wheel in installation operating with a $2\frac{1}{2}$ ft. lift has an efficiency of 85 per cent, for the wheel itself. A centrifugal pump of the same head and capacity would not be expected to have a plant efficiency greater than 15 or 20 per cent. For small quantities of water a wheel of this character can be driven by a treadmill or some other device operating with farm livestock, as the motive power. Stock used in this way would represent no investment for power, as during the time the owner is irrigating he would not be using his horses otherwise.

There are many other devices of one kind and another upon the market, which are from time to time advertised as great improvements in the art of pump-

ing water. It may be that some of these are highly meritorious. Investigation, however, usually leads to the conviction that the owners of the patents are not anxious to submit their apparatus to test and that what machinery they have made is of inferior mechanical design and that the efficiency is low. The market in which it is usually attempted to place these types of apparatus is that of the small farmer, who wishes to put in an inexpensive plant for irrigating a piece of high land. He is unable to see the fallacy in the theories advanced by the agent and frequently is victimized. The small owner is usually the man least able to carry out an experiment of this sort and obtain any advantage from it. It is much wiser for him to stick to standard machinery and standard methods of installation.

AN ENLARGED POWER PLANT FOR THE PANAMA CANAL.

Extensive changes have been authorized for increasing the capacity of the hydroelectric plant at Gatun, Panama Canal Zone. New turbine wheels have been ordered for the three turbogenerator sets, each of 400 h.p., instead of 3100 h.p., as at present. No change will be made in the generators, as the very liberal design of these units makes it possible to operate them with an output of 3650 kilovolt-amperes, at 80 per cent power-factor and 55 degrees C. temperature rise.

In order to take care of the increased output of these generators, four new 400,000-circular-mill cables have been ordered for installation between the hydroelectric station and the Gatun substation. The present cables between these two points are 10 in number, and of No. 0000 size.

In addition, two 4000-kilovolt-ampere power transformers have been ordered for the Gatun substation. These are the largest transformers that can be installed in the existing compartments. There is now one vacant compartment for one of these transformers, and the other compartment will be provided by moving one of the present 2667-kilovolt-ampere units to the Cristobal substation, where it will be needed to take care of the increased load at that point, due to the operation of the new coaling plant, terminal piers, and the projected submarine base.

CHILEAN-BOLIVIAN OIL SYNDICATE.

A syndicate known as the "Sindicato Petrolifero del Oriente Boliviano" has been formed by Chilean capitalists to exploit an area of 545,000 hectares (1,345,150 acres) of oil-bearing lands in eastern Bolivia. To carry on the work of exploitation as planned, subscriptions for approximately \$10,000,000 are to be raised, chiefly from the nitrate producers in the north of Chile who are desirous of securing an independent and economical source of fuel.

EDITORIALS ON THE RAILWAY WAGE ISSUE.

The Association of Western Railways, for the information of the public, is sending out complete lists of editorials by the American press on the railway wage issue, which seem to favor that a settlement be forced either by the Interstate Commerce Commission or by arbitration.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.

(Continued.)

Benton Project.—This project is located in the northerly end of Benton county, Washington, and it contemplates the irrigation of 109,000 acres of land lying above the Hanford project and below the area that is embraced in the proposed Yakima Valley Irrigation Project, a gravity and pumping scheme, as outlined in the King survey and report made for the Northern Pacific Railway Company in 1913. Pumpage is proposed to elevation 765 ft., which means a maximum lift, including friction losses of 362 ft. and a mean lift of 225 ft. from a pumping station located in Sec. 16, T. 13 N., R. 24 E., W. M. The cost estimate for project, omitting details, is made up as follows:

Pumping station complete.....	\$ 883,000
Pressure mains.....	75,000
Main canals and distribution system.....	3,410,000
Engineering and contingencies.....	874,000

Total\$5,242,000
Cost per acre for 109,000 irrigable acres.....\$ 48.09

It is true that the sandy character of the top soil and subsoil of this project will make for a low duty of water. Due weight was given to that factor in considering the feasibility of the project, and the above estimate was based upon the assumption of a delivery duty of 40 in. and a pumpage duty of 50 inches for an irrigation season extending from April 1 to October 15. It is true also that included within the boundaries of the project are some areas of sand dunes, but these latter have not been classed as irrigable lands and the project has been abruptly terminated at the southerly line of township 10, thereby excluding a large portion of them.

Despite the adverse criticism offered from time to time concerning this general Benton area, and despite the difficulties encountered by the Hanford Irrigation Company as to water duty and cost of pumpage, I am still impressed with the possibilities of this project and believe that an entirely practicable and economic development can be worked out for it on the basis of electric power pumpage. In the remaining Yakima River gravity supply, which can be made available by storage in the upper Yakima drainage basin, is to be applied to the bench lands above the Sunnyside canal and other nearer lands (and that appear to be its most economic application) then reclamation of the Benton area must depend on pumpage from the Columbia River, and every effort should be made to so reclaim it.

Alternative Power.—In connection with both the Priest Rapids and the Benton projects it is possible that local electric power may be developed and delivered at rates that could not be met by the Celilo development, with its necessarily long transmission line. Among these possibilities are Rock Island Rapids Cabinet Rapids and Priest Rapids on the Columbia River, all of which are in the proximate neighborhood of these irrigation projects. What these developments may cost and how they may compare economically with the proposed larger development at Celilo is not known, and I have therefore included the Priest Rapids and Benton projects as feasible even with power transmitted the long distance required from Celilo Falls.

Other Projects Included.—Among the lesser pro-

jects which are regarded as possible future users of Celilo power and special description of which are herein omitted, may be mentioned Grand Dalles, Roosevelt Flat, Beman Slope, Beverly, Arlington Gulch, Willows Slope, Blalock Island, numerous small areas between Miller and Arlington on the Oregon side of the Columbia and similar areas between Grand Dalles and Portland on both sides of the river which latter deserves an additional word for it differs in character from the other projects.

In the first place the district has an average annual precipitation of about 26 in. and in the second place its soils are somewhat heavier and less sandy than that of the irrigation projects further up the river and to the east of The Dalles. Unquestionably these soils are adapted to fruit and berries and vegetable culture and with the immediate proximity of Portland, which is bound to become a great metropolis, a permanent market is at hand for all that these favored areas could produce.

Although this district has an annual rainfall of 26 in. its rainfall during the summer months is only 4 in. and it is the deficiency of these months, a matter of from 12 in. to 15 in. for the entire season, which would need be made up by irrigation. The available are such as can be found in the vicinity of Mt. Pleasant, Butler, Cascades, Stevenson and Carson on north side of river and of Dodson, Warrendale and Cascade Locks on south side of river. Attractive benches are found here of from 100 acres to 1000 acres in extent and at heights of from 50 to 500 ft. and upward above the river. Probably 10,000 acres could be thus developed and devoted to intensive culture and because the small amount of water to be pumped and the favorable market conditions would permit very high lifts.

Yakima Valley District.—The fall of the Yakima River is such that gravity irrigation may be employed for nearly all the lands available for irrigation in that valley. There are, however, some opportunities for pumpage from wells, as for instance in the Moxee District, but so small an amount of power as required for such restricted areas could not be economically transmitted that distance and they could be more economically and more reliably served from local sources. There are also some larger possibilities of pumpage from canals to the bench lands above existing and proposed gravity canals. Cases in point are tracts above the existing Sunnyside Canal and above the proposed Wapato Project canals.

It seems possible, however, to serve all such tracts by direct hydraulic lift or by electric power derived from developments at drops in the gravity canals themselves and at costs below that at which Celilo power could be delivered. This feature is very well covered in the King Survey and report on the Yakima Valley Irrigation Project, already referred to, which shows an estimated cost of about \$41 per acre for the entire project embracing about 149,000 acres of gravity lands and 48,000 acres of pump lands.

Kennewick-Hover Slope.—This is a very attractive tract of bench land embracing about 10,000 acres to an elevation of about 300 ft. above the Columbia River. These lands lie above the Northern Pacific Irrigation Company Canal, which is also a partial pumping scheme deriving its pumpage water from a main gravity canal which heads on the Yakima River,

Below the N. P. I. Company canal there appears to be about 2500 acres having no water right and which could be readily served by pumping from wells with lifts varying from 25 to 50 ft. I have, however, disregarded all of these possible developments by reason of the fact that the proposed Yakima Valley Irrigation Project can serve the same areas by gravity and pumpage incidental thereto at a lesser cost than is possible by pumping from wells or from the Columbia River.

Snake River District.—Snake River throughout the 130 miles of its course from Clarkston to Pasco is confined between canon walls which rise from 500 ft. to 1000 ft. above the river. Some excellent bodies of land are found on these upper benches but they are generally too high to be served economically by pumpage from the river. Immediately along the river shore, however, numerous small flats and low benches are found which are of high fertility as demonstrated by existing farms and which, in the aggregate, amount to about 2000 irrigable acres between Pasco and Riparia and to about 1500 irrigable acres between Riparia and Clarkston, exclusive of the broad area which opens out immediately at Clarkston.

Many of the flats are already in cultivation, particularly in the section between Riparia and Clarkston, both fruit and forage culture being highly successful. Pumpage is by gasoline engine plants the lifts varying from 50 to 100 ft. For the areas above stated, lifts from 50 ft. to 150 ft. would obtain and for an average lift of 100 ft. it would appear that not to exceed 600 h.p. of electric energy would be required for the section Pasco to Riparia, nor more than 400 h.p. for the section Riparia to Clarkston.

To transmit so small an amount of power from the nearest prospective substation, to wit: the pumping plant of the proposed Three Rivers Slope Project in Section 2, T. 9 N., R. 32 E., would necessitate power rates for pumpage of from 0.80 cents to \$1.50 per kw.-hr. It is believed that these rates could not compete with power rates which might obtain from local sources i.e., by the use of internal combustion engines, by power which may be developed on the Snake River itself or, for at least the upper sections, by power derivable from Lewiston. For these reasons the Snake River Valley has not been included as a probable market for Celilo power for irrigation pumpage purposes, except at its mouth where the Three Rivers Slope scheme has been included.

Walla Walla District.—There is a small amount of irrigation pumping from shallow wells in this district at the present time, and there is a possibility of its extension. In the district lying immediately south of Walla Walla and on towards Milton and Freewater in Oregon there is a possibility of about 5000 acres being reclaimed by pumpage from shallow wells with lifts varying from 10 ft. to 60 ft., which, in the aggregate, might require about 500 h.p. of electric energy. I have estimated that so small an amount of power would not warrant the construction of a transmission service, the cost of power so delivered would be in excess of what such power might be supplied at from other sources.

Central Oregon.—As referred to in the initial section of this report, familiarity with this region from investigations previously made relieved the necessity for its detailed field examination at this time. How-

ever, some examinations were made to ascertain ground water conditions in the district about Pendleton, the result of which was adverse to there being any sufficiency of water for irrigation purposes from that source in that locality. Water is found in wells at depths of from 100 ft. to 400 ft. and while these wells are regarded locally as of good yield for stock purposes and domestic use they are apparently quite inadequate for irrigation.

In Central Oregon proper, however, some pumpage possibilities are known to exist, although these are not extensive, as pointed out in a report rendered by the writer in 1909 to the United States Reclamation Service entitled "Central Oregon Investigations—Irrigation Possibilities." Among those areas which would seem to offer pumpage possibilities may be mentioned the great Harney Valley with its 400,000 acres or more of good irrigable land, the Warner Lake and Silver Lake districts in Lake county, and that extensive territory lying between Rock Fort and Christmas Lake generally referred to as the Fort Rock Desert and embracing some 80,000 acres of excellent land. In all of these districts ground water is found at depths varying from 5 ft. to 40 ft., and the situation for pumpage would be inviting if only the water supply could be proven adequate as to quality and quantity.

Of the 400,000 acres of irrigable lands in the Harney Valley perhaps one-half can be served by gravity supplies from Silvies River, Silver Creek and Donner and Blitzen River. As to pumpage from wells from the remaining area I stated as follows in my report of 1909:

"Ground water as revealed by numerous wells is found at depths of from 6 ft. to 20 ft. These wells are used solely for domestic and stock purposes and no evidence is at hand as to whether their quality or quantity would permit their general use for irrigation. I have no doubt they are suitable as to quality but believe they would fail as to quantity. Prof. Russel of the U. S. Geological Survey expresses a strong conviction that there is an artesian supply of water underlying this area but this has not yet been demonstrated by the actual sinking of a well, though one unsuccessful effort was made in this direction."

I see no present reason for changing the general opinion then expressed, though it should be added that a more or less restricted area can and no doubt will ultimately be reclaimed by pumpage, for the gravity irrigation supplies brought in will tend to augment the normal ground waters available for pumpage.

In the Fort Rock District the ground water conditions are also of uncertain dependability as regards irrigation. Although the district embraces some 80,000 acres I believe that not to exceed 25,000 acres can ultimately be reclaimed by pumpage from ground water supplies. In reference to the same area Mr. Gerald A. Waring, in Water Supply Paper 220 of the U. S. Geological Survey, after expressing doubt as to the sufficiency of the ground water supply, expressed himself as follows:

"The quality of the sub-surface water should also be taken into account in considering its prospective use for irrigation, for it is all alkaline, at least all of the shallower water, which is all that has so far developed, and although perhaps its use for the first few years would not be noticeably injurious to crops, its continued use, if not carefully managed, could not fail to be."

(To be continued.)

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It is not the purpose of this editorial to take sides on the relative merits of the Hetch Hetchy project as opposed to other possible schemes of development. Nor it is the purpose to favor any present water or power company supplying San Francisco with these vital necessities of life, nor yet to add our mite in assisting those endeavoring to wrest from these corporations their present functions of public usefulness and make them city-owned. Rather is it our purpose to briefly call attention to an issue that the Hetch Hetchy, in its entirety, presents—an issue so far reaching in its magnitude as to shake the very foundation stones upon which future growth and development of the prosperity of California must ultimately rest.

At the outset, it must be admitted that four features of western life have been responsible for the gigantic commercial growth of that prosperous empire—namely salubrious climate surrounded by scenic beauty, fertility of the soil, cheap water power and abundant water for irrigation.

Much has been said as to the possible destruction of the scenic charms of the beautiful Hetch Hetchy Valley by the construction of the proposed San Francisco scheme of development. Go upon the ground yourself and you can not but admit that the Almighty in his wisdom has there created a thing of beauty. Yet this self-same beauty is combined with a marvelous utility, in the bounteous provision that has here been made to supply to man in abundance the very necessities so needed in the great commonwealth of California—power for her industries and water for her thirsty citizens and her barren lands. Indeed so bounteous is this provision that the usefulness of this gigantic reservoir is of such economic importance as to far outweigh any other consideration. Again when one visits the Hetch Hetchy this season and travels over the wonderful scenic road of compact granite already completed into the valley, one can not but realize that ultimately the great natural scenic beauty will be enhanced and become of far more accessibility to the average American beauty lover than formerly was possible.

So the real issue narrows down to reservoiring and diverting these waters in order that the greatest good may result to the greatest number of people.

The diverting of these waters to San Francisco will unquestionably result in supplying that city with sufficient water and power that will be ample for a future growth reckoned in the millions. Its diversion, however, does call into question important economic factors that cannot and must not be overlooked. Indeed, factors of such importance that only the strictest impartiality can decide, an impartiality that looks not to power interest, community interest, nor special privilege, but fundamentally to the full and harmonious development of all the state's resources so as to benefit all to the full extent of their development—not

twenty years from now—but throughout all posterity. For water in California may be likened to the "bold peasantry" described in Goldsmith's *Deserted Village*, when he said: "Princes and lords may flourish or may fade, but a bold peasantry when once destroyed may fade, but a bold peasantry, when once destroyed, can never be supplied."

It is not too late, by any means, for the citizens of California to rise and see that this entire project receives a hearing, so impartial, so all-searching in its investigations as to allay forever any possible regrets that may arise in the future.

San Francisco and her own citizens are themselves more vitally interested than any others. Destined to become perhaps the greatest business center of the growing pacific, her fruit laden ships, her boasted bank clearings, her towering commercial palaces must depend upon the prosperity and development of the great interior basins of California.

The issue is a stupendous one and one well worthy the most serious thought and investigation—one indeed that the entire West will watch with keenest interest.

Then let the people rise and give the Hetch Hetchy and other possible water supply sources for San Francisco such an impartial hearing that posterity may see how truly we loved them when our children's children come to review the wisdom with which we directed the harmonious development of the water resources of a great commonwealth.

And if it proves by impartial investigation that the present proposed Hetch Hetchy Development does not meet with the harmonious development of the state's resources let the project be abandoned for the one that will. If, on the other hand, such investigation proves the Hetch Hetchy Project to be in full keeping with the best development for all concerned, then let opposition forever hold its peace and let all give to the project that cordial and helpful support that is commensurate with its brilliancy and daring.

Since price fixing has rightly been tabooed by the Sherman anti-trust act, a demand has arisen for intelligent advice as to what price will yield a fair profit to the average electrical contractor and dealer. The catalogue or list price is usually somewhat greater than need be charged, whereas, in figuring a selling price based on his cost, a dealer is likely to overlook such items as overhead, frequency of turnover and legitimate profit. Price advice is needed.

To meet this need, it is planned to regularly publish in these columns a price index. This list is to be published on our own responsibility and is merely suggestive of what experience has shown to be a proper price to be charged. This list will be concerned primarily with materials used in electrical construction, wire, conduit, sockets and such. Under present conditions cost prices change frequently, so that it is well for the contractor to provide for as frequent a change in selling price.

The first installment of this price series appears in this issue, being arranged for easy removal and

filing. After the series has been completed, corrected sheets will be published regularly.

These price suggestions are prepared to meet the practical requirements of the electrical contractor. Their value is self-evident. Suggestions as to means for bettering the service will be appreciated by the editors. The idea is to help stabilize the electrical business by helping the men who constitute the foundation of the industry—the electrical contractor.

The next step in the upbuilding and strengthening of the electrical industry in the West should be the formation of a strong association embracing all interests within the one common interest of locality.

The central station, the engineer, the jobber and the contractor-dealer, no matter how diverse their several activities, have the one common problem of stimulating the electrical habit among the Western people. While national associations are well adapted to studying the general questions affecting each branch of the industry, the local association is needed to co-ordinate and apply the remedies suggested.

The electric range will suffice as a concrete example. The general electrical cooking situation was most ably discussed last June by the National Electric Light Association. The sales features have been considered by the National Electrical Supply Jobbers' Association and installation methods are being investigated by the National Electrical Contractors' Association. But concerted local action is necessary on the part of the central station, jobber and contractor dealer to interest the consumer and sell the ranges in each section of the country.

The full measure of benefits to be derived from extensive centralization can be obtained only by intensive sectionalization of effort. Each locality has peculiar conditions which can best be overcome by those most closely in contact with them.

A start in this direction has already been made by the Pacific Coast electrical jobbers in inviting representatives of the manufacturers and central stations to meet with them. The contractors, likewise, are welcoming these several interests at their meetings. One of the most important matters discussed at the meeting of the California Association of Electrical Contractors and Dealers last week was the formation of a Pacific Coast association. Delegates from both the Washington and Oregon associations were in attendance and plans were made for knitting the organization more closely together.

Among these several get-together movements it is greatly to be hoped that an amalgamation will be effected. Each can help the others and in their united effort can advance the prosperity of all. The jobber is in a position to teach better sales methods. The contractor can create a more favorable public opinion. The central station can co-operate to its own advantage with all other interests. Localization of effort makes for a more efficient activity.

PERSONALS

Geo. L. Dillman, consulting engineer at San Francisco, is in Idaho.

O. B. Penrose, sales manager Fobes Supply Company of Portland, is at Oakland, Cal.

B. M. Levy, manager Great Western Power Company at Santa Rosa, was at San Francisco this week.

Ed. Whaley, secretary Northern California Power Company, is spending his vacation in Trinity County, Cal.

F. G. Baum, consulting engineer at San Francisco, is expected to return this week from a visit to his ranch.

R. Tomlinson, of Pierce-Tomlinson Co., has returned to Portland after attending the electrical contractors' convention.

Arthur Mathews, manager of the Nevada, California & Oregon Telephone Company, is at San Francisco from Reno.

F. S. Mills, engineer with National X-Ray Reflector Company, has opened an office in the Rialto Building, San Francisco.

T. W. Simpson, Pacific Coast manager Federal Sign System (Electric), is attending a branch managers' meeting at Chicago.

John Coffee Hays and **H. Y. Hall**, consulting engineers at San Francisco, are attending the military training camp at Monterey.

C. A. Malone, purchasing agent California-Oregon Power Company, with headquarters at San Francisco, is at Fort Stevens, Ore.

H. A. Laidlaw, electrical engineer with the operation and maintenance department of the Pacific Gas and Electric Company, is at Lake Spaulding.

H. L. Tinling, electrical contractor of Spokane, has returned home from the contractors' meeting at Stockton, where he represented the Washington Association.

E. D. Pike, manager of the Pacific Coast Service Department of the Wagner Electric Mfg. Company has returned to San Francisco from a business trip to Los Angeles.

W. D. Kohlwey, owner of the Kohlwey Light Company of San Francisco, is at New York City, as a delegate to the convention of the National Electrical Contractors' Association.

G. F. Wakeman of the Edison Storage Battery Company, is expected to return to San Francisco this week after a three months' trip through the northwest and the intermountain country.

Geo. R. Murphy, Pacific Coast manager Electric Storage Company, will remove his offices from the Rialto Building to a general service station in Van Ness avenue, San Francisco, about the first of August.

F. W. Hild, vice-president and general manager of the Denver Tramways Company, is visiting at Portland on business. Mr. Hild was formerly general manager of the Portland Railway, Light & Power Company.

H. P. Munger, Pacific Coast manager Hughes Electrical Company, has returned to his headquarters at Salt Lake, after an extended trip to Portland, Seattle, Spokane and Boise. While in Portland he sold one of the largest apartment houses a complete electric range installation.

Attilla Norman, vice-president and general manager of the Oregon Power Company, has resigned. His successor will be appointed by Mr. Elmer Dover, president of the Northern Idaho & Montana Power Company and president of its subsidiary, the Oregon Power Company, with headquarters at Tacoma, Washington.

Rudolph W. Van Norden consulting engineer at San Francisco announces that a new hydroelectric generating plant which he has designed and installed at Folsom Prison, Cal., for the State of California, has been placed in operation. This plant is interesting from the fact that it is the lowest

head installation on the Pacific Coast, the normal operating head being about 8 ft. The plant is in two units with a total rated capacity of 400 kw. While this is a comparatively small installation, the generators and turbines, due to the exceedingly low head and slow speed are very large and heavy. The turbine runners measure over 7 ft. in diameter and stand 5 ft. high, and each weighs 8000 lb.

OBITUARY.

William A. McGovern, general manager of the Northern Electric Railway Company, died suddenly Saturday evening July 15, 1916, at his cottage on Lake Tahoe, where he had gone for a short vacation with his sister and daughter. Death was due to heart disease. Mr. McGovern was dancing on the bay pier with relatives and friends. After an evening of recreation he said goodnight at 10 o'clock and left for his room. Twenty minutes later his sister went to the room and found him lying on the floor unconscious. The body was taken to Berkeley, where the funeral was held.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

A special meeting was held July 12th to complete arrangements for participation in the preparedness parade on July 22nd. Chairman A. E. Drendell announced that the electrical division would probably have 3000 men in line. T. E. Collins was appointed marshal in charge. Resolutions of sympathy were also adopted with reference to the death of J. Harry Pieper of Los Angeles.

Great Western Power N. E. L. A. Section.

The regular monthly meeting of the Great Western Power Company Section of the National Electric Light Association was held at the Hotel Washington, San Francisco, July 10, 1916, with an attendance of 75. E. A. Wilcox presided at the meeting, which was addressed by A. L. Lerch, of the American District Steam Heating Company, and J. K. Fairchild, secretary of the section, who spoke on "Financing of Municipal Enterprises."

TRADE NOTE.

Crocker-Wheeler Company announce that on or about July 22nd they will move their present offices to larger quarters on the ground floor of the Crossley Building, No. 87 New Montgomery street, and will, as heretofore, carry a large stock of motors for immediate shipment.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has issued an order granting the San Joaquin Light & Power Corporation permission to issue \$666,500 of first and refunding mortgage series "C" six per cent gold bonds at not less than 96 per cent of their face value and accrued interest. The proceeds from these bonds is to reimburse treasury for additions and betterments already made, and for purchase of transformers.

The commission issued an order granting authority to the Central California Gas Company to issue \$7000 of bonds and \$30,000 of stock.

Oro Electric Corporation and subsidiary companies have applied to the commission for authority to sell their public utility properties to the Pacific Gas & Electric Company. The purchasing company seeks authority to issue \$1,755,000 of its general and refunding mortgage gold bonds at 85 to reimburse its treasury in the amount of \$1,491,151.35 expended to acquire \$1,830,000 face value of bonds of the Oro Electric Corporation. Under the agreement of sale the Pacific Gas & Electric Company is to purchase at 92½ plus accrued interest \$670,000 face value of Dredging Company bonds, the proceeds to be used to redeem the bonded indebtedness of Oro Water, Light & Power Company and Oroville Light & Power Company and to pay the floating indebtedness of Oro Electric Corporation and subsidiary companies.

CALIFORNIA ELECTRICAL CONTRACTORS' CONVENTION.

The seventh annual convention of the California Association of Electrical Contractors and Dealers was held at Stockton, July 14-16 with an attendance of nearly 200. The convention was without doubt the most successful yet held, not only in point of attendance but also as regards action taken; particularly noteworthy was the representation of central stations, as well as of jobbers and manufacturers. Preliminary plans were made for a Pacific Coast Association of Contractors, with the possibility of united action by the other interests.

The convention was called to order Friday morning by President C. V. Schneider. After a few preliminary remarks, Mr. Schneider introduced Mayor A. C. Oullahan, who heartily welcomed the electrical men to Stockton. After fitting reply had been given by A. H. Elliott, President Schneider presented his annual report. This briefly summarized the progress of the association during the past three years, during which period Mr. Schneider has successively and successfully served as president. With all modesty he ascribed credit for this success to the assistance of the various committees and officers. He told of the re-organization of the association and of its co-operation with the jobbers and central station, laying particular stress on the benefits gained from these harmonious arrangements. He showed how the idea had recently spread, not only on the Coast but throughout the East. The close affiliation with the central station has led to recognition of the contractors' rights as regards the maintenance of retail prices, as well as a clear field in house wiring. Future indications, in the mind of President Schneider, are most hopeful for a more general prosperity throughout the electrical industry.

In the afternoon a short business session preceded a joint meeting between the jobbers, contractors and central station representatives. At this meeting a new district consisting of Marin, Sonoma, Napa, Mendocino and Humboldt counties was formed and San Mateo county was added to the San Francisco District. Strong endorsement was given the idea of an inter-state conference board, preliminary to forming a Pacific Coast Electrical Contractors' Association. Not only was the idea backed in person by the representatives of the Oregon and Washington Associations, but telegrams were also received from the British Columbia Association saying that any movement welding together similar associations on the Pacific Coast would receive their support.

While these business matters were being discussed by the contractors the ladies in attendance conducted a card tournament.

The joint meeting of the contractors, jobbers and central stations was held under the chairmanship of L. P. Gilpin. At this meeting, addresses were made by Mr. C. F. Butte, representing the San Francisco contractors, M. L. Scobey, representing the San Francisco dealers; N. Ellis, representing the Oakland contractors; C. E. Arbogast, representing the Los Angeles contractors, J. R. Tomlinson, representing Oregon; H. L. Tinling, representing Washington; S. V. Walton, E. A. Wilcox and Samuel Kahn, representing the central stations, and W. L. Goodwin and W. S. Berry, representing the electrical jobbers.

In the evening an informal dinner *dansant* was held on the roof garden of the Hotel Stockton, which was greatly enjoyed by all present.

Saturday morning was devoted to unfinished business and to the election of officers. Under the head of the former was included a report by J. Gensler, regarding the organization and general conditions of Oakland. C. F. Butte, as chairman of the Telephone Specifications Committee, presented a report and recommendations that efforts be put forth to retain telephone installations as part of the contractors' work rather than have this work done by the telephone company. H. C. Reid presented a report of the Standardization Commit-

tee particularly as regards the work in connection with the Industrial Accident Commission of California. Frank Somers reported full and favorable co-operation from the power companies with the association.

The election of officers resulted in Mr. F. J. Somers of San Jose being made president for the ensuing year with the following vice-presidents in charge at their respective districts: H. C. Reid and M. L. Scobey, San Francisco; N. F. Nagle and J. Gensler, Oakland; L. F. Yondall, Stockton; C. V. Schneider, Sacramento; W. E. Hayes, Santa Rosa.

Co-Operation with the Central Station.

On Saturday afternoon a most interesting open meeting was held. This started with an address by Mr. Samuel Kahn, manager of the Western States Gas & Electric Company, who spoke of the development of co-operation between the central station and the contractor-dealer. He said in part: "A tug-of-war between common interests is not co-operation. The weak are vanquished—the victors are left in a state of exhaustion. To pull is effort and effort expanded in the right direction is useful and results in achievement to a greater or less degree. The modern principles of good business demand co-operation for the good of the service and the greater the co-operation the bigger and better the rewards." He defined the first step toward co-operation as acquaintanceship, which stops unjust criticism, the second, as local organization, which brings unity of thought and action in solving local problems, and the third as general organization, which handles the larger and more general problems. After tracing the early history of central stations, which originally chose to do certain sales and construction work until the contractors had proved their ability, he showed how these campaigns of education eventually benefited the dealer. He stated that the central stations will abandon the electric ranges, for example, after this period of education has been passed. In his opinion the lighting uses of electricity are becoming secondary to the power service and that every additional application means greater work for all.

Development of the Electrical Organization.

Mr. W. L. Goodwin then spoke at length of the development and growth of the electrical organization. He stated that the present movement had its inception two years ago last November, at a time when the electrical business was in a most deplorable condition. The central stations were being attacked by municipal ownership demagogues, manufacturers and jobbers were being attacked by governmental agencies and dealers were suffering from poor business conditions. Previous organizations of the contractors, said Mr. Goodwin, had been based largely on the principle of fixing prices. As this was prohibited by the Sherman Law, which, incidentally, made no provision for the continuance of such associations, considering only their evils, it was at first thought the association must disband. Yet really, price fixing proved to be the least of the work that could be accomplished by associations. These conditions applied to all associations throughout the country. As regards the Association of Electrical Jobbers, Judge Deberville met with representatives of the Department of Justice and explained to them so ably the purpose of the jobbers in educating their membership that he had no difficulty in persuading them of the justice of such an association.

After two years of successful effort, the jobbers concluded that a similar organization would help the retailer. The retailers were somewhat doubtful at first as to the benefits accruing from purely educational work but finally saw the necessity for such an organization.

The electrical retailers are recruited from the ranks either of young engineers or mechanics, both of whom lack business training. They are greatly in need of development along commercial lines. They do not understand that profit is essential

to business. Yet the government cannot afford to have business men in business unless they made a profit and so it is natural that the government should encourage any association which will teach men how profits may be made.

Each interest, that is, the manufacturer, central station, contractor and jobber, had separate organizations, whose activities were confined largely to their own problems. They were continually, though unintentionally, fighting each other. By seeing their common interest they were brought to a common ground and the movement, as started in Central California, has grown to be a strong organization.

A similar organization in Southern California is most prosperous and recently like associations have been formed in Washington, Oregon and British Columbia. As a result of this work, central stations that formerly thought it right to merchandise electrical devices at cost have been educated to the idea that there are other men in the industry whose prosperity reflects prosperity on the central station interests. By allowing profit to the other men they are enabled to make more profit themselves.

Manufacturers, likewise, have ceased to be so aggressive in the field at the expense of others. The jobber also has established a code of ethics intended to protect and help the other man. While the conditions are not yet perfect they show a great improvement and the movement will undoubtedly grow as it gains the support and confidence of the Federal Trade Commission.

After briefly explaining the reason for his earnest endeavors in this connection, Mr. Goodwin showed how the attitude of the Federal Trade Commission has changed as it has become better acquainted with the purpose of the trade association. Whereas formerly their remarks were confined to cost accounting, recently they have laid great stress on the value of organizations of business men for educational purposes. He concluded his address by reading a portion of Chairman E. N. Hurley's recent speech before the Associated Advertising Clubs of the World, which proves the strong endorsement which has been given the association movement by the government:—

The Federal Trade Commission is endeavoring today to work out a comprehensive, constructive solution of our business problems. We have taken definite steps toward getting at the real facts of industry from manufacturers. Within a few months we hope to be able to give manufacturers first-hand detailed information about their business.

The activities of trade associations and similar business organizations are manifold. Groups of associated business men that are putting forth special efforts to improve systems of cost accounting, bettering their processes of manufacture, standardizing their output, obtaining credit information, and endeavoring to advance the welfare of their employees, are bound to be most important factors in our country's development in the course of the next few years.

Special commendation should be given to associations that are endeavoring to build up industries in these constructive ways. Successful production and successful merchandising require many steps in the process of changing the form of the raw materials and putting the product on the market at a figure adequate to cover the cost of production and the cost of selling and net some profit to the producer, without charging the consumer an excessive price; and neither the individual manufacturer nor the Government alone can work out the many serious economic and business problems involved so successfully as can a group of associated producers or merchants laboring together in co-operation. These associations, when conducted intelligently and rationally, with the thought of bringing about improved business conditions, will make it possible for our industries to compete in price and quality in the markets of the world.

There should be a greater degree of organization and of mutual helpfulness in all lines of trade and industry, so that American business may be welded into a commercial and industrial whole, the part of the Government being to co-operate with business men, on request, to bring about the results that will benefit business and hence promote our national welfare.

President Wilson's views on trade associations may be of particular interest to you. In a letter addressed to me, under date of May 12, 1916, he said, in part:

The White House,
Washington, May 12, 1916.

.....
Your suggestion that trade associations, associations of retail and wholesale merchants, commercial clubs, boards of trade, manufacturers' associations, credit associations, and other similar organizations should be encouraged in every feasible way by the Government seems to me a very wise one. To furnish them with data and comprehensive information in order that they may more easily accomplish the result that they are organized for is a proper and useful Government function. These associations, when organized for the purpose of improving conditions in their particular industry, such as unifying cost accounting and bookkeeping methods, standardizing products and processes of manufacture, should meet with the approval of every man interested in the business progress of the country.

It is my hope that, in addition to the other work which the Federal Trade Commission is doing, it will ascertain the facts regarding conditions in our various industries. If it finds that an industry is not healthy, it should, after carefully considering the facts, in co-operation with the parties interested, suggest a practical and helpful remedy. In this way many of our difficult business problems might be solved.

I am very anxious to see you continue to co-operate with the business men of the country along the lines upon which you are working.

Cordially and sincerely yours,
WOODROW WILSON.

Governmental Co-Operation.

Harris J. Weinstock, California State Market Director, then gave an excellent address on Government Co-Operation with Association Work, which he humorously defined as making for "an improved order of white men." He stated that the lack of standard has caused much unnecessary suffering among the industries. The way to establish standards is through organization. He illustrated this by the work being accomplished by the State Market Commission, which was created in order that the producer get a better price for his product without any hardship to the consumer.

Mr. Weinstock then refuted several criticisms which had been directed against this plan, the first being the question of special legislation for the farmer. He showed that all other lines of business have been helped by special legislation and that the farmer is the last to be aided. Answering a criticism that this was socialism, he explained that socialism no longer stands for everything that is evil and vicious; while its objective is visionary and unobtainable, yet it is advocating many wise and beneficent things which we should be prudent enough to adopt. He stated that the postal service is socialistic, that public schools, public highways, county hospitals, are undertakings by the people for the people without profit.

In answering the objection that this also was paternalism, he showed that paternalism is of two kinds—that which helps and that which hurts.

Replying to the criticism that this was but another political machine, he argued that through the medium of the nominating primary the day of the political boss had passed and bribery had been eliminated. He cited the success of the state-managed accident insurance commission and also the building of public highways in California and was of the belief that it was perfectly safe to invite a political commission to handle the matter.

Trade Acceptances.

Mr. Russell Lowry, president of the First National Bank of Oakland, then spoke on Trade Acceptances. He explained that the present system of open book accounts has come into general use in America only since the Civil War. Previously, notes at hand or acceptance drafts were in general use. After the war, many of the old firms had gone out of

business and new firms of unknown credit standing had come into the field. In order to do business with them, the jobbers offered cash discounts which have since brought an attendant train of evils. These abuses include the unjust advantage given to one who can pay cash, he thus really getting a rebate or price differential and so working hardships on the man with limited capital. In practice, the expiration date has not been rigidly insisted upon and a most slipshod and careless method of meeting obligations has ensued. A return to the old method should make people more careful in assuming obligations and should give the merchant and manufacturer access to new reservoirs of capital.

The trade acceptance is a negotiable instrument which offers prima facie evidence of a transaction, whereas the open account is merely a memorandum which may be repudiated by the buyer.

To the jobber and manufacturer it has three advantages: (1) it gives legal evidence of the correctness of a bill and the date on which it is to be paid, (2) it is discountable at more favorable terms and (3) jobber can obtain a larger and cheaper credit and thus require smaller capital.

The banker considers it superior to a promissory note, which gives no record as to the purpose of the loan, whereas the trade acceptance defines the obligation, is self-liquidating and likely to be paid at maturity. It has been used almost exclusively in Europe for many years and has proven most satisfactory.

To the retailer, also, it offers the advantage of better service from the jobber without increase in cost. If bills are not paid promptly the jobber is compelled to minimize his selling service. It will also prevent overstocking and lead to more careful and thorough collections.

Mr. Lowry doubts whether the trade acceptance should be sought from the ultimate consumer, primarily because of the vital difference between the credit to the consumer and the credit to the retailer. When the jobber extends credit to the retailer it is a productive credit, when the retailer extends credit to the consumer it is a consumptive credit. Furthermore the retailer sells in small quantities and to a large number of people and in the majority of cases will find that the trade acceptance merely amounts to giving a more extended term of credit than with the present method of doing business. In conclusion, Mr. Lowry dwelt on the larger aspects of the situation in benefiting the business man by providing reservoirs of commercial credit. With the trade acceptance, a commercial bank can extend greater credit with the utmost freedom. It, in a measure represents a sacrifice all along the line for the general welfare.

A. E. Drendell then gave a brief account of the plans for the Preparedness Parade on July 22d and urged all possible to participate therein. Closing remarks were made by Albert H. Elliott and the convention adjourned.

Banquet and Picnic.

Saturday evening one hundred and sixty members and guests sat down to a fine banquet, where F. H. Somers, president-elect, acted as toastmaster. Mrs. Schneider, the wife of the retiring president, was presented with a handsome silver tea-service and talks were made by A. H. Elliott and H. C. Reid. The dinner was interspersed with pleasing entertainment features and at its conclusion dancing was indulged in to a late hour. On Sunday a trip was taken down the river to a pleasant picnic ground where all enjoyed a little relaxation after the more arduous duties of the business sessions had been concluded.

The arrangements for the convention were made by a general committee, consisting of M. A. De Lew, San Francisco, chairman; C. V. Schneider, Sacramento; H. C. Reid, San Francisco; M. F. Nagle, Oakland; L. B. Gilpin, Oakland; F. J. Somers, San Jose; L. F. Youdall, Stockton.

Ways and Means Committee: C. F. Butte, W. D. Kohlway, G. Sittman, Geo. J. King, L. F. Youdall, T. Scott, W. E. Hayes.

Program: H. C. Reid, G. I. Kenny, N. M. Hope, P. L. Bennett.

Entertainment: A. F. Flanagan, M. L. Scobey, H. S. Tittle, Mrs. A. F. Flanagan, Mrs. M. A. De Lew, Mrs. C. V. Schneider.

Reception: Mr. and Mrs. A. F. Flanagan, Mr. and Mrs. J. Gensler, Mr. and Mrs. C. B. Kenny, Mr. and Mrs. W. D. Kohlway, Mr. and Mrs. F. H. Somers.

The following registered at the meetings:

Contractors.

L. J. Bennett.
G. H. Andrews, Oakland.
G. E. Arbogast, Los Angeles.
C. D. Bass and wife, Stockton.
W. A. Blair, San Francisco.
Geo. W. Brouillet and wife, San Francisco.
C. F. Butte and wife, San Francisco.
A. E. Commerford, Stockton.
C. L. Chamblin, San Francisco.
H. H. Courtright, Fresno.
M. A. De Lew and wife, San Francisco.
N. P. Ellis, Oakland.
P. Decker and wife, San Francisco.
E. E. Elza, Fresno.
C. J. Franke and wife, Stockton.
A. F. Flanagan, Stockton.
J. Gensler and wife, Oakland.
C. O. Gould and wife, Stockton.
F. J. Greisberg, San Francisco.
L. P. Gilpin, Oakland.
G. S. Haller, San Francisco.
W. E. Hayes, Santa Rosa.
J. F. Hetty and daughter, San Francisco.
W. W. Hill, Stockton.
W. P. Hyatt.
S. G. Jackson and friend, Berkeley.
Hugh W. Kimball, Oakland.
G. J. King, Oakland.
Robert King, Oakland.
C. B. Kinney, San Francisco.
Louis Levy and wife, San Francisco.
Frank C. Lyman, Stockton.
W. L. Mitick, Oakland.
Fred Moore, Alameda.
M. F. Nagle, Oakland.
J. M. Nightingale, Modesto.
A. E. Nylan, Oakland.
A. Patzer, Stockton.
J. W. Redpath, San Francisco.
H. C. Reid, San Francisco.
C. S. Renwick and wife, Richmond.
T. Scott, Sacramento.
M. L. Scobey, San Francisco.
C. V. Schneider and wife, Sacramento.
E. C. Shafer, Stockton.
Geo. A. Sittman, San Francisco.
Geo. D. F. Smith, San Francisco.
Frank J. Somers and wife, San Jose.
C. E. Stanley and wife, Stockton.
H. P. Stow, San Francisco.
H. S. Tittle and wife, San Francisco.
J. R. Tomlinson, Portland.
Hugh L. Tinsling, Spokane.
F. J. Wallace, Lodi.
Harry S. White, Stockton.
L. F. Youdall and wife, Stockton.
Electric & Machine Equipment Co., Stockton.
Electric Engineering & Supply Company.

Jobbers

W. S. Berry, Western Electric Company.
C. H. Carter, Pacific States Electric Co.
Geo. G. Drew, Pacific States Electric Co.
A. H. Elliott, San Francisco.
W. L. Goodwin, Pacific States Electric Co.
M. E. Hickox, Pacific States Electric Co.
C. C. Hillis, Electric Appliance Company.
J. W. Hooker, Thos. Day Co.
H. H. Hoxie, Electric Ry. & Mfrs. Supply Co.

Frank Killam, Pacific States Electric Co.
W. B. Lewis, Western Electric Company.
W. C. Martinez, Western Electric Co.
R. F. McDonald and wife, Holabird-Reynolds Co.
A. Meinema, Electric Appliance Co.
M. S. Orrick, Western Electric Company.
H. A. Sayles, Holabird-Reynolds Co.
H. F. Schultz, Electric Appliance Co.
A. E. Skillicorn, Pacific States Electric Co.
W. D. Thomas, Electric Ry. & Mfrs. Supply Co.
C. E. Wiggins, Dunham, Carrigan & Hayden Co.
C. J. Winslow, Electric Appliance Co.
A. Youngholm and wife, Electric Ry. & Mfrs. Supply Co.

Central Station.

H. A. Abernathy, Pacific Gas & Electric Co.
H. H. Adams, Oro Electric Corp.
J. M. Hall and wife, Pacific Gas & Electric Co.
Samuel Kahn and wife, Western States Gas & Electric Co.
Lee H. Newbert, Pacific Gas & Electric Co.
S. V. Walton, Pacific Gas & Electric Co.
E. A. Wilcox, Great Western Power Co.

Miscellaneous.

R. J. Guyett, San Francisco.
Electrical World.
Journal of Electricity, Power and Gas.
Electrical Review and Western Electrician.
W. A. Murphy, City Electrician, Stockton.
A. J. Cleary, Board of Fire Underwriters.
L. A. Lewis, Oakland Board of Education.

Manufacturers.

R. M. Alvord, General Electric Co.
R. A. Balzari and wife, Westinghouse Elec. & Mfg. Co.
A. E. Drendell, Drendell Elec. & Mfg. Co.
T. E. Bibbins, General Electric Company.
G. A. Gray, Crouse-Hinds Co.
S. B. Gregory, Arrow Electric Company.
W. B. Hall, Pass & Seymour, Inc.
J. C. Manchester, Interstate Electric Novelty Co.
R. W. Murphy, Westinghouse Lamp Co.
W. C. North, General Electric Company.
Paul V. Quick, Landers, Frary & Clark.
F. H. Poss, Benjamin Electric Company.
Frank Quinn, Manhattan Electric Supply Co.
A. E. Rowe, Telephone Electric Co.
H. E. Sanderson Bryant Electric Co.
W. B. Sawyer, U. S. Steel Products Co.
H. B. Squires, San Francisco.
H. F. Yost, Trumbull Electric Company.



NEWS NOTES



INCORPORATIONS.

CARLTON, ORE.—Prune Center Telephone Company, \$6000, by C. F. Jenson, H. J. Kellogg, W. H. Meedel and F. B. Weidner.

SALT LAKE CITY, UTAH.—Duchesne Power Company, \$25,000, shares \$100 each, by J. S. Dean, president; W. H. Cammerer, W. L. Dean et al.

ILLUMINATION.

STOCKTON, CAL.—The board of library trustees has awarded the contract for installing a new lighting system to E. L. Gnekow for \$1780.

VISALIA, CAL.—The sum of \$50,000 will be spent by the Central California Gas Company for improvements in the Visalia generating station.

FRESNO, CAL.—Sealed bids will be received by the supervisors up to August 8th for the installation of an electrolight system in Court House park.

PHOENIX, ARIZ.—A petition has been presented to the city commission protesting against the calling of an election to determine whether the city shall build a municipal lighting and gas plant.

WICKENBURG, ARIZ.—A \$17,000 bond issue has been voted for the purpose of making additions and improvements to the existing water system and the installation of an electric plant.

MERCED, CAL.—The trustees have decided to form a lighting district to embrace the business section. Chas. T. Phillips of San Francisco has been engaged to outline plans for the district.

PHOENIX, ARIZ.—A proposition has been made to the city by the South Side Gas & Electric Company for the sale of its entire holdings to the city. A committee has been appointed to make investigations as to the advisability of the deal.

WATTS, CAL.—A resolution of intention has been adopted by the board of trustees for the improvement of Melvin avenue from Shorb avenue to Main street, by the construction of ornamental electrolights on the east side of the street.

SUNNYSIDE, WASH.—V. V. Vercce in the interests of the Pacific Power & Light Company, has asked the council to consider a 50 year franchise. The company will erect an office building at the site of the substation if the franchise is granted. He also offered to install new street lights.

TRANSMISSION.

CHICO, CAL.—The Pacific Gas & Electric Company is making improvements to its substation in this district.

RANDOLPH, UTAH.—The Swan Creek Light & Power Company has signified its willingness to extend its line into Randolph this summer.

OAKLAND, CAL.—The Great Western Power Company has paid \$6522 into the city treasury, which represents 2 per cent of the gross receipts of the corporation from October 25, 1914, to October 25, 1916.

NEWPORT, WASH.—The Northern Idaho & Montana Power Company is figuring on building a transmission line from the Newport substation to Dalkena to furnish power for the new plant of the Hedland Box & Shingle factory.

RIVERSIDE, CAL.—The Southern Sierras Power Company has applied to the supervisors for a franchise to operate for 50 years electric transmission lines along all public highways in Riverside county. Sealed bids will be received for such a franchise up to August 9th.

PRATTVILLE, CAL.—The corps of engineers located at Butt Valley, Plumas county, and employed by the Great West-

ern Power Company, is still running lines for the system of canals and tunnels to connect the Neviss Dam at a point near Prattville with a proposed plant at the mouth of Yellow Creek, near Humbug Valley.

WOODLAND, CAL.—The Northern California Power Company has been given a franchise to operate in any part of the county exclusive of incorporated towns. It is understood that the company will confine its activities to the Dan-nigan district, in the northern part of the county, the Pacific Gas & Electric Company having failed to extend its lines to that section.

IRRIGATION.

BUTTE CITY, CAL.—The Western Canal Company, which has completed its irrigation system on the west side of Butte Creek, is prepared to extend its canals to the Colusa county line if the farmers in that section will sign up for the water.

REDDING, CAL.—It is reported that George W. Peltier, the Sacramento banker, and E. G. Hopson, former chief engineer of the reclamation service, have purchased all the real estate holdings of the Emma Joseph estate in Shasta county. It is said that the owners want to put all the land under irrigation from the Anderson-Cottonwood district.

YREKA, CAL.—A. L. Harlow of Montague, who with Oakland men has been placing several thousand acres of sage brush land under irrigation in the Big Springs district and placing settlers thereon, has purchased 500 acres of the level valley land south of Grenada and is to commence operations immediately to place the tract under irrigation.

LINDSAY, CAL.—The directors of the Lindsay-Strathmore irrigation district have voted to re-advertise for bids for the construction of the system. This action was taken following a request from a number of bidders who were unable to have their bids completed by the date originally set for the opening of the bids. The bonds, amounting to \$1,400,000, will also be re-advertised for sale.

RIVERDALE, CAL.—Users of water in the Laguna and Riverdale conservation districts are preparing to take advantage of the proposed building of the Pine Flat storage. Petitions will ask the supervisors to call an election to vote for the establishment of an irrigation district to include these points. Engineers at work on the scheme to reclaim the Tulare Lake basin say that the general plans are progressing rapidly.

MODESTO, CAL.—The Turlock irrigation district is coming in for its share of the \$254,000 to be paid to the Modesto irrigation district by the Waterford irrigation district upon an agreement entered into between the two districts, whereby Waterford is to receive water diverted from the La Grange dam, according to a demand made by the Turlock district in the form of a resolution presented at the adjourned meeting of the directors of the Modesto irrigation district.

Wanted and For Sale

The rate for advertisements in this column is \$1.00 per insertion for 25 words or less; additional words 2 cents each, payable in advance. Remittance and copy should reach this office not later than Monday noon for the next succeeding issue. Replies may be sent in care of the Journal of Electricity, Power and Gas, Crossley Building, San Francisco.

OPEN FOR ENGAGEMENT—Competent accountant and licensed attorney, having fourteen years' experience as chief accountant, cashier and secretary of large electrical firm in San Francisco, open for position July 20th. Moderate salary. Apply Box 111, Journal of Electricity, Power and Gas, Crossley Bldg., S. F.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, JULY 29, 1916

PER COPY, 25 CENTS

SKIN EFFECT AND ITS PRACTICAL TREATMENT.

BY CLEM COPELAND.

FLOODING METHODS OF IRRIGATION.

BY S. T. HARDING.

PROSPECTIVE MARKET FOR IRRIGATION
PUMPING.

BY JOSEPH JACOBS.

THE ELECTRICAL DEALERS' PROBLEM.

BY MAX LOEWENTHAL.

HOW TO COMPUTE RATING OF AUTOMOBILES.

BY ROBERT SIBLEY.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries

Edison Storage Battery Co.

Boiler Feed Water Treatment

Dearborn Chemical Co.

Carbon Products

National Carbon Co.

Conduit and Cable

Sprague Electric Co.
Baker-Joslyn Co.

Electric Ranges

Pacific States Electric Co.

Electrical Slate

Davis Slate & Mfg. Co.

Electrical Supplies

Electrical Ry. & Mfrs. Supply Co.
Pacific States Electric Co.

Insulators

Hemingray Glass Co.
Pierson, Roeding & Co.

Insulator Pins

McGraw-Hill Mfg. Co.

Motors

Century Electric Co.
Wagner Electric Mfg. Co.

Oil Burners

Leahy Mfg. Co.

Piping

Pittsburg Piping & Equipment Co.

Power Plants

Chas. C. Moore & Co.

Resistance Units

Ward Leonard Electric Co.

Steam Turbines

General Electric Co.

Theatre Dimmers

Cutler-Hammer Mfg. Co.

Transportation

Southern Pacific Co.

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Pelton Water Wheel Co.

Transformers

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THE ELECTRIC RANGE

Electric Cooking
is here, and
gaining following
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Help it along
and add to your
profits.

*The G-E Range
will help you*

Show samples in your store.

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The Modern Electrical Supply House

LOS ANGELES OAKLAND PORTLAND
SAN FRANCISCO SEATTLE

Address our nearest house.

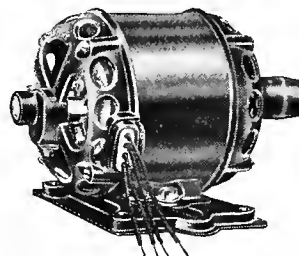
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Fractional Horse Power

SINGLE PHASE MOTORS

($\frac{1}{10}$ to $\frac{1}{4}$ H.P.)

are now being supplied as standard equipment by many manufacturers of such apparatus as is usually connected to a



lighting circuit because their low starting current does not impair the satisfactory lighting service which a successful Central Station Operator must render to his customers.

Other sizes up to 30 Horse Power

THEY KEEP A-RUNNING.

CENTURY ELECTRIC CO.

19th, Pine to Olive Streets, St. Louis, Mo., U. S. A.

Western Sales Offices and Stocks at San Francisco, Portland, Los Angeles, Seattle, Spokane, Salt Lake City

Member Society for Electrical Development—Do It Electrically 222

Visit Beautiful Lake Tahoe

and the
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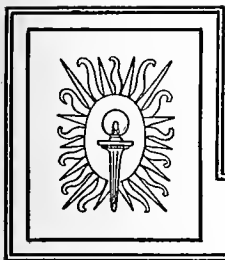
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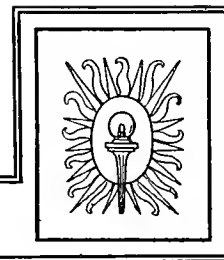
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SKIN EFFECT AND ITS PRACTICAL TREATMENT

BY CLEM A. COPELAND.

(The fact that an alternating current flows largely through the outer cross-section of a transmission wire, tending to forsake the central area, has long caused a troublesome problem in properly designing conductors and in predicting accurately the electrical phenomena that may result when the line is put into operation. In the following article and in a series of articles which will appear later, the author sets forth in its completeness the practical method of attack in order to properly handle this complicated problem. He explains the theory in an open, free manner devoid of higher mathematics, as he progresses in the discussion. The discussion draws upon the latest experimental data of the U. S. Bureau of Standards and other sources of information, calling attention to the fact that many formulas still appearing in current text books on the subject are incorrect. In this article the author shows by numerical illustration how the "skin effect" in any ordinary size of wire, rod or cable of solid cylindrical form composed of any non-magnetic metal at any frequency, up to say 3,000,000 cycles at any temperature may be readily and accurately found. The author is technical assistant engineer with the Los Angeles Aqueduct.—The Editor.)

Introductory.

When an alternating, oscillating or pulsating voltage is impressed upon a conductor of any form of cross-section, the resultant current forsakes the innermost filaments parallel with the direction of flow and crowds to the surface of the wire, cable or bar. This phenomenon is termed "skin effect," and is due to the fact that the deeper filaments have the greater self-induction and impedance to the flow of current.

The effects are more pronounced—

- (a) The larger the superficial area of conductors for any given cross section.
- (b) The greater the frequency of alternation, oscillation or pulsation of the current.
- (c) The greater the magnetic permeability of the conductors; and
- (d) The smaller the specific resistance of the material.

The reasons for the three former influences are quite self-evident, while the influence of the specific resistance is of a more obscure nature.

The results of the phenomenon of "skin effect" are:

- (a) The ohmic resistance of any conductor is greater for a varying current than for a direct or continuous current of the same value.
- (b) The inductance of a non-permeable conductive material, such as copper, aluminum, zinc or mercury, is smaller than it would be if the skin effect were absent; and
- (c) The inductance of a permeable conductor, such as iron, steel, nickel and cobalt, is smaller than it would be if the skin effect were absent, but of course much greater than for the non-permeable substances.

The constantly increasing size of long distance transmission line conductors as the growth and combination of large systems occurs; the employment of bi-metallic wires and cables to obtain a high tensile strength; the use of iron and steel conductors in the place of, and on account of excessive cost of copper and aluminum and for special transmission uses; the increasing size of generators and transformers; and the employment of sustained high frequencies in wireless engineering, are among those factors which render the knowledge of skin effect of growing importance.

The phenomenon becomes prominent in non-magnetic wires or cables larger than .6 in. in diameter with 50 or 60 cycles and in smaller conductors at higher frequencies. Conductors used in connection with electric furnaces carrying upwards of 20,000 amperes must be subdivided "in order to use the conducting material to the best advantage and reduce its resistance to a minimum. The relative position of the conductors has also to be considered in order to prevent them from shielding one another. Mixing the phases reduces this effect and at the same time minimizes the reactance of the circuit, a matter of generally greater importance than the increase of resistance due to the unequal distribution of current in the conductors."

Skin effect is especially prominent in conductors of any ordinary size consisting of magnetic materials, from a No. 16 wire at 60 cycles to a steel rail used as the return in an alternating current railway system at 15 cycles, a 100 lb. rail, for instance, having 8.5 times more ohmic resistance at this frequency than for direct current.

The phenomena is of importance in rectangular busbars having the greatest dimension of cross-section

$\frac{1}{2}$ in. or more, in large low voltage transformer conductors, in continuous and alternating current generator conductors and in the conductors of standards of measurements and measuring instruments.

The present discussion will be limited to the consideration of the skin effect in connection with the flow of truly or approximately sinusoidal alternating currents.

The mathematical determination of the skin effect on the resistance and inductance in non-permeable cylindrical bars or tubes, when the return conductor is distant several times the diameter of the conductor or when the return conductor is concentric with the one being considered, is one of the most beautiful and exact demonstrations of mathematical physics. Perhaps no more charming and complicated illustration of the agreement between theory and practice exists. Unfortunately the complete understanding of the problem involves an advanced course in differential equations. The co-ordination of the results of theory and practice, only will be summarized herein for practical reference.

The mathematical determination of the skin effect in permeable conductors of any form is impossible. It is rarely possible in conductors of any material, whether non-magnetic or magnetic, if not cylindrical in form or when the conductors are close together. As will be presently shown there is recourse to experimental and empirical curves which enable the solution of most any ordinary problem in a more or less satisfactory manner.

Non-Magnetic Cylindrical Conductors—Solid Wires or Rods.

Referring to Fig. 1, suppose a sinusoidal alternating current to be flowing in a direction at right angles to the paper through the conductor whose cross-section is shown at A_1 . The return conductor A_2 is assumed to be an infinitely great distance away and the conductor A_1 under consideration is assumed to be straight and of an infinite length.

The shading of the cross-section of Fig. 1, roughly represents the density of current, which is more accurately illustrated by the curve below, giving the exact maximum current density per circular mil at various points along the diameter as a function of the current density at the center, i.e., the current never reaches more than .00002 of an ampere in the circular mil forming the axis of the conductor, while in the layer of circular mils forming the "skin" of the conductor the current reaches a maximum at some instant of time of .003 of an ampere, or 150 times greater than at the center, while the whole conductor is carrying an average of .00058 of an ampere per circular mil.

The case just cited is that of a 22,564,400 circular mil cylindrical copper conductor 4.7502 in. in diameter at 68 deg. F. carrying a 60 cycle alternating current of 13,087 amperes.

The same distribution of current would obtain in a conductor of copper .47502 in. in diameter at a frequency of 6000 cycles per second.

In these instances it is seen that the inner part of the conductor, having a diameter of fully half of

the total diameter, or one quarter of its area, could be dispensed with without seriously affecting the resistance to alternating currents.

The engineer is perhaps more concerned with the effects of this phenomena on the characteristics of the circuit which influence the power and voltage efficiency of the transmission.

Consider the characteristics of the circuit as illustrated in Fig. 1 as follows:

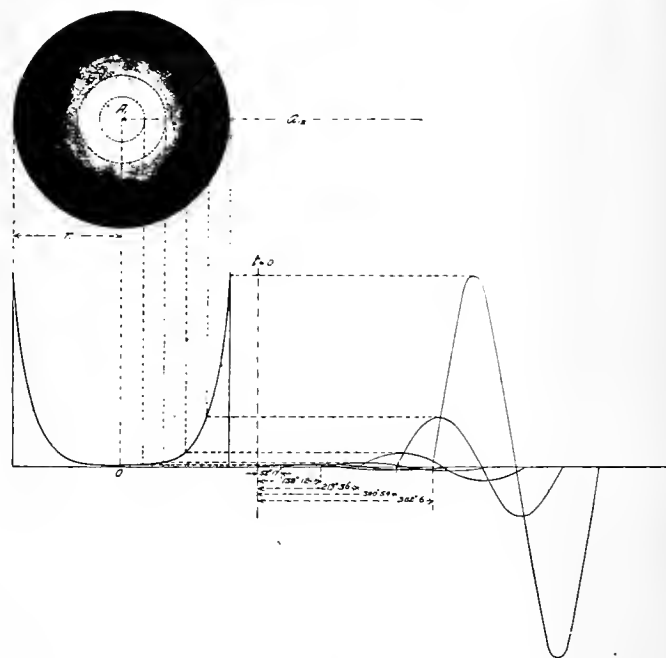


Fig. 1.

R_{dc} —the resistance of the conductor to direct current in ohms or the resistance to an alternating current of the same root-mean-square value, if there were no skin effect.

R_{ac} —the resistance of the conductor to alternating currents in ohms; resulting on account of skin effect.

K_R —The ratio R_{ac}/R_{dc} (Always greater than unity).

L_{ide} —the coefficient of self-induction of the circuit in henries, due to the lines of force obtaining on the interior of the conductor which would result by virtue of a direct current, or if there were no unequal current distribution while an alternating current of the same root-mean-square value obtained. As a matter of fact this value is always .00001524 henries per thousand feet of conductor in the case of non-permeable conductors. In other words, unit direct current in the conductor would produce .00001524 of a line per thousand feet on the inside of the conductor itself, regardless of the size of the conductor.

L_{iac} —the interior coefficient of the self-induction in henries due to the alternating current which results from skin effect.

K_L —the ratio L_{iac}/L_{ide} , always less than unity, theoretically, when non-magnetic conductors are used, possibly less than unity for nickel or cobalt, but always greater than unity for iron or steel.

L_e —the exterior coefficient of self-induction in henries, which is the same for either direct or alternating currents and independent of the material of the conductor, being in the above instance equal to $(.000140366 \text{ Log}_{10} 24000/r_1 - .0000609602)$ henries per 1000 ft. of conductor, being the number of lines exterior to the conductor produced by one ampere in the conductor; in which

r_1 = radius of conductor in inches;

f = frequency in cycles per second.

Organizing the above quantities, we have

Z_{ac} = Impedance in ohms by virtue of skin effect.

$= \sqrt{[R_{ac}^2 + 4 \pi^2 f^2 (L_{iac} + L_e)^2]}$

$= \sqrt{[K_R^2 R_{dc}^2 + 4 \pi^2 f^2 (K_L L_{dc} + L_e)^2]} \dots \dots \dots (1)$

$= \sqrt{[K_R^2 R_{dc}^2 + 4 \pi^2 f^2 (K_L .00001524 + .000140366 \text{ log}_{10} 24000/r_1 - .0000609602)^2]}$

For convenience this may be written in the following form:

$$Z_{ac} = \sqrt{(K_R R_{dc})^2 + 4 \pi^2 f^2 \left[\frac{K_L 15.24}{10^6} + \left(\frac{140.366}{10^6} \text{ log}_{10} \frac{24000}{r_1} - \frac{60.902}{10^6} \right)^2 \right]} \dots \dots \dots (2)$$

in ohms per 1000 ft. of conductor

Lord Rayleigh and others have developed exceedingly complicated formulae for the determination of

K_R and K_L , which require mathematics beyond the scope of this paper for their satisfactory understanding. Recently, however, extended tables have been prepared rendering equation (2) easy of solution.

These ratios depend upon the value of the argument

$$\aleph = \sqrt{\frac{2(2\pi r_1)^2 f}{\rho}} = \frac{2\pi r_1}{.3937} \sqrt{\frac{2f}{10^9 \rho}}$$

$= 22.570 r_1 \sqrt{\frac{f}{10^9 \rho}} \dots \dots \dots (3)$

ρ = Specific resistance of the conductor in ohms per centimeter cube, that is the resistance of one centimeter length of a conductor one centimeter in cross-section, at the temperature existing in the conductor at the time.

The mathematical development of (3) theoretically involves the permeability μ , thus $\aleph = 22.570 r_1 \sqrt{(\mu f/\rho)}$. Practically, however, this has no application as will be shortly shown.

Having r_1 , ρ and f , determining the argument, \aleph , the Table I has been calculated by the U. S. Bureau of Standards for finding K_R and K_L .

It is important to note from the argument \aleph and the above table, that K_R increases and K_L decreases directly with the superficial area of the conductor, the square root of the frequency and inversely as the square root of the specific resistance.

The following are average values of ρ which may be used in connection with (3) in the absence of measured values:

Table II.

Aluminum, hard drawn at 20 deg. C.....	2,828.0
Carbon (Arc-Lamp)	4,000,000.0
Constantan	50,000.0
Copper, soft drawn, at 0 deg. C., 32 deg. F.....	1,589.7
Copper, soft drawn, at 15 deg. C., 59 deg. F.....	1,690.5
Copper, soft drawn, at 20 deg. C., 68 deg. F.....	1,724.1
Copper, soft drawn, at 25 deg. C., 77 deg. F.....	1,757.6
Copper, hard drawn, at 0 deg. C.....	1,632.0
Copper, hard drawn, at 15 deg. C.....	1,738.0
Copper, hard drawn, at 20 deg. C.....	1,773.0
Copper, hard drawn, at 25 deg. C.....	1,806.0
Copper sulphate, concentrated solution.....	21,739, 100,000.0
Gold	2,222.2
Graphite	from 250,000 to 1,250,000.0
Iron	from 9500 to 13,000.0
Lead, Ave. approximate, at 20 deg. C.....	19,000.0
Manganin	41,667.0
Mercury	943,396.0
Neckelin	41,667.0
Platinum	10,000.0
Silver, Ave. approximate at 20 deg.....	1,600.0
Steel	13,000 to 22,000.0
Tin, Ave. approximate at 20 deg. C.....	10,000.0
Zinc, Ave. approximate at 20 deg. C.....	6,000.0

As regards practical frequencies involved the following may be of service for reference:

Table III.

Commercial frequencies:	
On the Pacific Coast .....	.50 and 60
In general, in U. S. ....	.25, 40, 60, 133
In England, mostly .....	.50 and 100, but many
of 40, 60, 67, 68, 70, 75, 77, 80, 83, 83.5, 87, 87.5, 90, and 93	
In Japan, "Of 774 generators, 30 operate at 25 cycles, 226 at	
50 cycles, 467 at 60 cycles, 9 at 100 cycles, 19 at 125	
cycles, and 23 others at various odd frequencies."	
Radio frequencies	350,000 to 3,000,000
Lightning phenomena	10,000 to 1,000,000
Telephone frequencies:	
- Pitch of average man's voice.....	85 to 160
Pitch of average woman's voice.....	150 to 320
Maximum involved in ordinary speech.....	3,000
Highest frequency of speech, produced by whisper-	
ing Z	5,000
Frequency in speaking u.....	1,100
Musical sounds: Lowest audible sound av. person	16 to 24
Highest Do.....	12,000 to 41,000
Lowest perfect musical note, E, of double bass.....	41 1/7
Highest orchestral note, d of piccolo flute	4,752

Illustrative of the use of this treatment take the extreme case shown in Fig I; thus:

Problem I.

$$r_1 = 2.3751.$$

$$f = 60.0 \text{ cycles.}$$

$$10^9 \rho = 1724.1 \text{ abohms at } 20^\circ \text{ C.}$$

$$\kappa = 22.570 \times 2.3751 \sqrt{(60/1724.1)} = 10.000.$$

Reference to Table III shows:

$$K_R = 3.79857; K_L = .28162.$$

which may be substituted in equation (2), determining the true resistance, inductance and impedance of the circuit.

The accuracy of this method is almost imperceptibly impaired when the return conductor extends parallel to and only a short distance from the one under consideration, in which case the formula of the characteristics of the circuit is changed to the following:

$$Z_{ac} = \sqrt{\left(K_R R_{dc}\right)^2 + 4\pi^2 f^2 \left[\frac{K_L 15.24}{10^6} + \frac{140 36612}{10^6} \log_{10} \frac{A_{12}}{r_1}\right]^2} \quad (4)$$

in ohms per 1000 ft. of one wire only, the other wire having the same impedance, provided that it is the same kind and size of conductor.

Here A_{12} = interaxial distance between the conductors A_1 and A_2 in inches.

It should be observed that if the circuit is short, say 50 ft. in length, and the distance between conductors is great, say 60 inches, L_e is influenced by the presence of the end connections and a complicated formula for the exterior self induction, of a rectangle must be used as follows, and substituted in equation (1);

R_{dc} = the total d.c. resistance of the entire rectangle, in ohms.

L_{idc} = the total internal self-induction.

$$= \frac{15.24}{10^9} \cdot \frac{2}{12} \left(1 + A_{12}\right)$$

henries, where l = the interaxial length of the rectangle in inches.

$$L_e = \frac{30.48}{10^9} \cdot \frac{41}{12} \left[\log_{10} \frac{A_{12}}{r_{1,2}} + \frac{A_{12}}{1} \log_{10} \frac{2 A_{1,2}}{r_{1,2} \left(1 + \frac{A_{1,2}}{1}\right)} - \frac{2 A_{1,2}}{1} + \frac{2 r_{1,2}}{1} \right]$$

= the total external self induction for the entire rectangle.

For rectangles approaching a square a still more complicated formula must be used for great accuracy.

Recently Mr. A. E. Kennelly has verified the correctness of the above treatment for copper and aluminum conductors in a thorough fashion, as shown in the following series of tests on No. 0000 B. & S. copper wire, the return conductor being 24.082 inches in interaxial distance, A_{12} , from the other. The conductors consisted of specially selected soft copper rods of about 101.3% new A. J. E. E. standard of conductivity.

Table IV.

A_{12} in.	Cycles, f.	Temp. C°	Observed		Computed	
			K_R	K_L	K_R^1	K_L^1
24.082	60	23.5	1.0038	1.024	1.0046	.9977
	306	24.2	1.111	.9714	1.108	.9463
	888	25.0	1.578	.7456	1.571	.7311
	1600	25.6	2.042	.5742	2.036	.5599
	2040	26.2	2.279	.5126	2.261	.4959
	3065	27.1	2.694	.4099	2.701	.4071
	3950	27.4	3.034	.3618	3.028	.3595
	5000	27.9	3.361	.3195	3.371	.3202

Verifying the third line in the above table for illustration, we have:

$$\text{Argument } \kappa = 22.570 \times .23 \sqrt{888/1735.73} = 3.713.$$

Interpolating in Table I between 3.7 and 3.8 there is obtained

$K_R = 1.571$ and $K_L = .7311$, which differ by 1% and 2% respectively from the experimental values.

The discrepancy is greater in the case of K_L since it was found by subtracting a calculated $K_L L_{idc}$ from the total observed self-induction of the circuit.

The discrepancy in the above case with K_R is greater than at any of the other frequencies, and the error is eliminated entirely when a curve is drawn connecting f , K_R and K_L as shown in Fig. 3. These results are remarkable when the intricacies of the problem are understood from a mathematical, physical and practical standpoint.

No. 0000 aluminum wires were also tested and show a similar perfect agreement with the theoretical calculations.

The results in Table IV and those for the No. 0000 aluminum wire are shown in the curve of Fig. 3, being the two lower curves in the "nest."

It has been previously inferred that this discussion was not accurate when the conductors were near together. The reason for this lies in the fact that parallel currents traveling in opposite directions with the lines of force around such currents, opposite in directive force produce a mutual inductive disturbing effect, causing an eccentric distribution of current over the cross-section of the wire.

Referring to Fig. 1, in which the return conductor is at an infinite distance away, it is seen that the interior lines of force ϕ_i as well as the exterior lines ϕ_e form concentric circles about the axis of the conductor.

In Fig. 2 there is illustrated the condition induced by virtue of the two conductors being close together, wherein the current is crowded to the inner crescents of the conductors and the interior and exterior lines ϕ_i and ϕ_e are eccentric with the axis of the conductors.

This "proximity effect" on the "skin effect" is nicely illustrated by Table V and the curves in Fig. 3 as results of further tests by Kennelly, wherein it is seen that as the No. 0000 wires are brought closer together, K_R increases rapidly above the value given by the U. S. Bureau of Standards in Table I. In general this table can be used when $A_{12} > 2.5 r_1$, up to the commercial distribution or transmission frequencies of 133 cycles and when $A_{12} > 125 r_1$, up to say, 7500 cycles and perhaps far beyond, with No. 0000 B. & S. copper wire.

This nest of curves is valuable as forming a very reliable basis, for a preparation of other sets of curves for any special case, by interpolation and inductive

reasoning which could be made sufficiently dependable for ordinary use.

TABLE V. Being an Extension of Table IV. See curves of Fig. 3.			
A_{12} Inches.	Cycles, f .	Temperature, C°	Observed, K_R
8.334	60	17.2	1.0058
	288	15.2	1.106
	868	15.2	1.584
	1663	15.0	2.120
	2061	14.9	2.313
	3063	15.2	2.755
	3112	15.4	2.781
	3860	15.3	3.067
	5040	15.4	3.446
	5320	...	3.558
2.9795	60	18.5	1.0087
	266	18.9	1.100
	582	19.3	1.354
	923	20.4	1.640
	1465	20.7	2.037
	2019	20.9	2.344
	1992	21.0	2.322
	3028	21.0	2.851
	3960	21.6	3.145
	5320	...	3.558
.7748	60	...	1.0124
	239	...	1.132
	671	...	1.604
	1068	16.3	1.981
	1509	16.5	2.330
	1991	16.9	2.643
	1988	17.2	2.638
	2486	17.8	2.912
	3028	18.0	3.179
	3880	18.3	3.587
.47165	4900	18.4	3.995
	60	21.1	1.0172
	236	21.4	1.244
	740	21.5	2.231
	1000	21.5	2.688
	1473	21.2	3.460
	2038	21.0	4.272
	3058	20.9	5.522
	3918	21.0	6.449
	5170	21.1	7.512

Such a process is illustrated in Problem III (appearing in a future issue), which could be extended for the insertion of other curves between the ones shown.

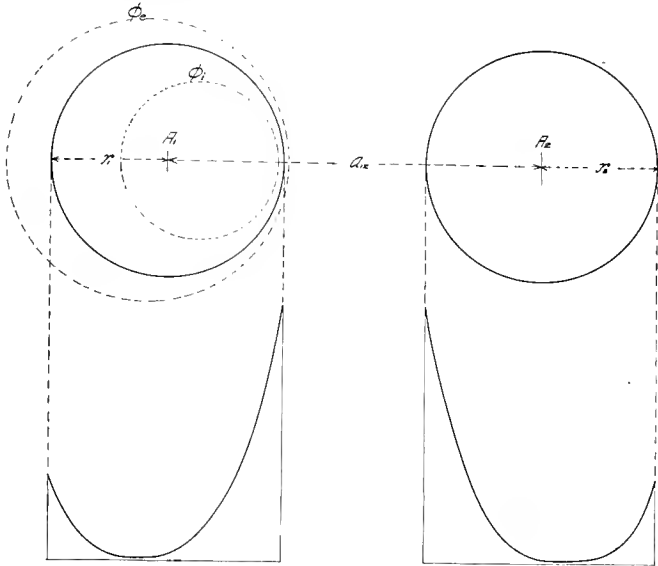


Fig. 2.

The "skin effect" in any ordinary size of wire, rod or cable of solid cylindrical form of any non-magnetic metal at any frequency, up to say 7500 cycles, at any temperature, is therefore very readily and accurately found, if we except cables between 1200 and 7500 cycles.

(To be continued.)

Philippine water-power sites are not being developed at present. Several concessions have been granted, but the concessionaires are apparently waiting more favorable conditions.

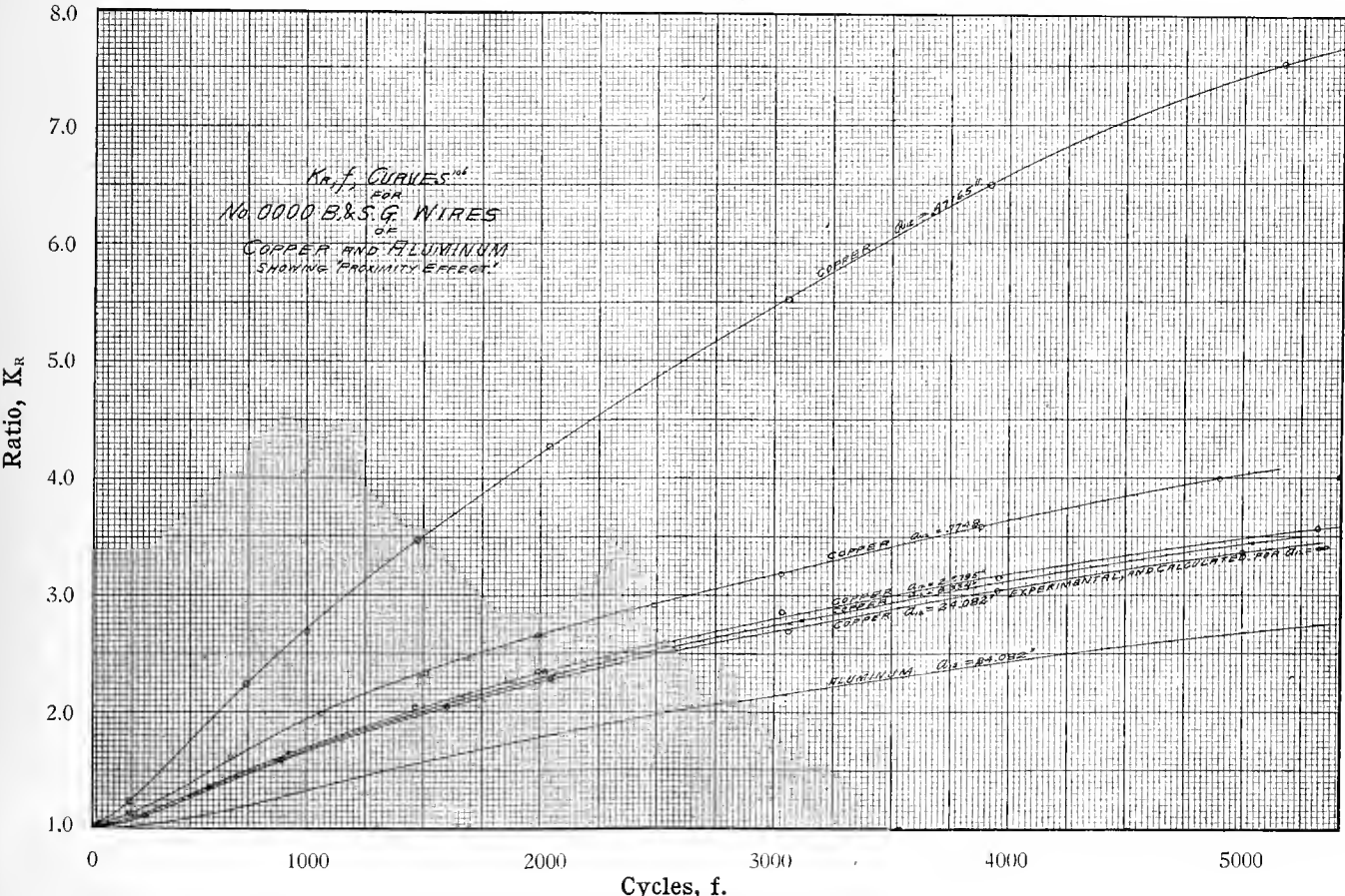


Fig. 3.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

PREPARING LAND FOR FLOODING METHODS OF IRRIGATION WITH SMALL HEADS.

Importance of Careful Preparation of Land.

The importance of carefully preparing land for irrigation is now generally realized. This is particularly true where water is secured by pumping. Any water saved by more efficient methods of application



Flood Method of Irrigation.

results in a direct financial saving in the cost of pumping. Where water is secured from gravity systems on a flat rate per acre, such savings may not be as direct. Also, where power is secured on a flat rate per year, the saving with a given plant may not be as evident. With all sources of water supply, however, a higher efficiency in use results in a direct saving to the irrigator in the labor cost of application, and the more uniform distribution over the land.

The irrigating stream, or head, as it is called, secured from the usual individual pumping plant, is relatively small. A number 4 centrifugal pump, which is a quite common size for farms of 40 acres or less, will usually discharge a little less than one second foot or about 450 gallons per minute. A number 6 pump will discharge about 2 second feet or 900 gallons per minute. In California the usual irrigating heads under gravity canals vary from 5 to 20 second feet. For farms larger than 40 acres, larger pumps may be used if the wells are able to supply larger flows. Wells for individual farms, developed to yield over 2 second feet or 900 gallons per minute, are not usual, however. In some localities, the wells will not supply as much as 400 gallons per minute and smaller pumps are used. For such conditions where flooded crops are to be irrigated, the use of reservoirs is often desirable.

This discussion will be limited to methods of flooding with heads of 2 second feet or less. Irrigation by furrows involves different methods of distribution and will be separately discussed.

Irrigation by Flooding Defined.

By flooding irrigation is meant those methods by which the whole surface of the field is covered by the flowing water. With furrow irrigation, only a portion of the surface comes in direct contact with the irrigation stream. Various methods are used for flooding, those most usual under small pumping plant practice being the border, strip, or gravity check, the rectangular or square check, and in some cases the contour check. The free flooding from laterals, so usual in the irrigation practice in the mountain states, is but seldom used in the coast states when the supply is pumped.

In choosing the method to be used on any field, several factors must be taken into consideration. The most important of these are the character of the soil, the topography of the land and the crop to be grown. Other factors to be considered are the value of water and crop and the size of irrigating head available.

The character of the soil affects the preparation of the land in a number of ways. The moisture-holding capacity determines the frequency of irrigations. Where frequent irrigations are necessary, greater care in preparing the land is warranted, as the total saving per season is greater. For porous soils, smaller areas or lengths of run of the water over the surface are essential. The type of soil affects the slopes that can be used without washing.

The topography determines the direction of checks, and their sizes and slope. While for small checks it is possible to re-level the ground to give the slope desired, the limitations of cost make it necessary to adjust the arrangement to the topography as far as possible. This can best be done by making a topographic survey and map of the field. Where much levelling is required, such a map will often save several times its cost in the adjustments of checks to the land,



Smoother Used for Preparing Lands.

so as to reduce the amount of earth to be handled. It is particularly useful on land of uneven or rolling surface.

Alfalfa is the principal flooded crop grown under small pumping plants. Such crops as grain may be used for short periods, but most of the land prepared for flooding is planned for use in alfalfa. Cultivated crops are usually handled by furrow irrigation.

How the Irrigation Is Planned.

In planning the irrigation of a field, one of the important points to be considered is the size of the checks. This should be determined from an understanding of the conditions of flow of water over soils and its absorption. On porous soils it is difficult to secure uniform application. The area adjacent to the point where water is turned into a check absorbs water for a longer time than the part of the check furthest from the turnout. In order to secure reasonably uniform application, it is necessary to either reduce the size of checks or increase the rate of flow. On heavy soils it may be difficult to secure sufficient absorption, and the land should be prepared so that water can be run for relatively long periods in each check.

Various observations have been made on the rates at which soils absorb water. In applying water to dry soil, particularly where the surface has been previously loosened as by cultivation, a rapid initial absorption or filling of the surface will take place. Following this, absorption is more uniform, the rate depending on the moisture properties of the soil. Such rates of absorption can be observed in a number of ways. One method on which there are many published measurements is to observe the rate of seepage from canals and express it in terms of the depth per day over the wetted area of the canal. From such observations, it has been concluded that for impervious soils the rate of absorption averages about 6 in. in depth per 24 hours; for rather pervious soils, 12 in.; and for pervious soils, 18 in. For porous soils, such as sands and gravels, it may amount to 3 ft. or more per day. The rate of absorption on fields during irrigation should be somewhat higher than these rates for canals continually subject to percolation. For some of the heavy adobe soils, the rate of absorption may be as low as 2 in. per day; on very sandy soils it may be as high as 10 ft. per day. Observations in India gave results varying from 6 to 16 in. and averaging 8 in. per day for loam soils, and from 1 to 5 ft. with an average of 22 in. for sandy soils.

Rate of Absorption Factor Determining Size of Checks.

The importance of the rate of absorption in controlling the uniformity of application can be seen when the area on which different sizes of irrigating heads will be completely absorbed at different rates is considered. In Table I the area required to completely absorb flows of $\frac{1}{2}$, 1 and 2 second feet are given. From this table it is seen that if one-half second foot or the discharge of a number 3 pump is turned into a check, the soil which absorbs water at the rate of 18 in. per day, the whole would be absorbed on 0.7 acres. If such a check contained one acre, all the flow would be absorbed before the steam reached the further end of the check. The area of the check should be adjusted so that the proportion of the flow being absorbed will not be large, in order that the larger part of the head may be available for reaching the further portion of the checks.

Table I.—Areas in Acres on Which Different Sizes of Irrigating Heads Will Be Entirely Absorbed for Different Rates of Absorption.

Rate of Absorption, in. in Depth per 24 hr.	Size of Irrigating Head		
	One-half Sec. ft. or 225 gal. per Minute.	One Sec. ft. or 450 gal. per Minute.	Two Sec. ft. or 900 gal. per Minute.
6	2.0	4.0	8.0
12	1.0	2.0	4.0
18	.7	1.3	2.7
36	.3	.7	1.3

If it is considered that at least one-half of the total head should be available for advancing the flow across a check, and not over one-half be absorbed at any time by the area covered, the maximum size of checks for the different conditions would be one-half the areas given in Table I. This emphasizes the need of small



Fields Being Flooded for Irrigation.

checks or of large heads in handling porous or sandy soils. For medium or heavy soils other conditions usually limit the size of checks to not over one acre per second foot of supply.

Care in preparing land for small heads is relatively more important than for large heads. As the depth of flow over the check is usually small, smaller variations in levelling will increase the difficulty of covering the whole area. Small checks require the moving of less earth on a given field than large ones, as they can be more closely fitted to the topography. The length of levees or dikes and usually of field ditches is greater, however.

Checking of Land Should Be Well Done.

Checking land, to be well done, requires a considerable amount of careful finishing. Such finishing materially affects the uniformity and ease of irrigation. The quality of the finished work cannot be defined in specifications or determined by ordinary inspection. For this reason, such work is not well suited to being handled by contract, but can best be done by the owner of the land himself. On rough land, involving the moving of considerable amounts of earth in pulling off high spots and filling holes, the general grading can often be handled by contract, but even where outside teams are employed it is usually preferable to hire them on a day basis, rather than at an acreage rate.

The Fresno is the implement most commonly used in levelling land. For larger tracts, some of the different forms of power graders give economical results. For usual pumping conditions, the areas are too small to warrant the purchase of such equipment, although if available it may sometimes be hired to advantage for the general grading. For the smaller checks, particularly the narrow strip checks, an ordinary road grader can be used to advantage.

LETTERS TO THE EDITOR.

The Electrical Dealers' Problems.

Sir:—Contrary to custom, I shall begin this discussion with a P. S., namely, a Preparedness Sentence, by stating that this intended letter has assumed the proportions of an article, for the length of which I make apologies and for the publication of which you may earn no one's gratitude but my own. I cannot, however, any more than a fish can refrain from entering the water, desist from participating in the discussion of the "Electrical Dealers' Problems," so ably expounded in the paper by M. L. Scobey, published in your columns last week.

I wish to state at the outset, for obvious reasons, that, regardless of my present business connection, I hold no brief for, nor do I represent in the presentation of these views, any firm or interests, but that my sympathies (please note the plural, singular as it may seem after reading what is to follow) are now and always have been with the electrical interests, particularly the electrical dealer. This must be evident to anyone who is acquainted with my activities in the electrical field, covering a period of 27 years, as manufacturer, jobber, dealer, electric business organizer, central station sales manager, editor and teacher, certainly a multiphase experience, enabling me to view the situation from every angle. I believe, furthermore, that business relationships, like personal friendships, lose much of their fervor and value when they resolve themselves into "mutual admiration societies" and that occasional jolts and criticisms resulting from a sort of inventory of one's views and interests by someone who is honestly concerned about them, are as wholesome as they are desirable.

And surely, if this be true, it applies most forcibly to a discussion of the retail end of the electrical industry, which in Mr. Scobey's own words, has been, up to two years ago, "The tail-end of the industry, whereas it should be the foremost." He regrets the fact that: "The stores outside of the electrical industry are disposing of from three to four times as many electrical devices as the electrical shops," and he makes the laudable plea to "reclaim the business and get it flowing in the proper, natural channels—namely, to the retail electrical dealer." He admits that the electrical stores have been "sadly neglected," that "80 per cent of the buying is done by women," that "it is to the advantage of the public to buy electric devices at an exclusive electrical shop," and that while he states that "we should show our appreciation of the jobbers by supporting them," he admits that "it is quite evident that the manufacturer is beginning to realize that there is such a person as the electrical dealer." These and other statements are food for further thought and discussion, based on the writer's personal experience and observation.

I admire Mr. Scobey's introspection, which has led him to recognize the dealer's shortcomings and difficulties and his laudable purpose of having him come into his own by earning for himself the respect, confidence and support of the buying public. But I venture to attack the problem from a different and perhaps broader angle than may be included in the improvement of sales methods and the motives which are

actuating the jobbers and central stations in giving their support to the electrical dealer, while not for a moment denying similar treatment to the department, hardware and drug stores, which are generally accused of price cutting and robbing the electrical dealer of his legitimate means of livelihood.

We must not, in our discussion, also lose sight of the fact that the manufacturer in trying to find an outlet for his product, has the hardware and household goods jobber to deal with in addition to the electrical jobber and that the former will support and supply a class of dealers which the latter would and could not reach through his salesmen. So at the outset we must absolve the electrical jobber from any responsibility if "approved" electrical merchandise reaches a non-electrical, undesirable dealer, nor can we blame the factory desiring to find a wider market for its product than can be found by the electrical jobber through his natural ally, the electrical dealer. I mention this merely to show the complexity of the situation which becomes further involved through the entrance into the field of the so-called non-association jobber, the "out-of-town" purchasing syndicates, the factories selling direct to "almost" jobbers or large dealers and also the many electrical jobbers admitting that the "non-electrical" business is extensive and desirable. And that we may not think for a moment that such an outlet is diminishing or unworthy of recognition let me quote from a recent article in the Housefurnishing Review on "Electrical Merchandising":

"There is no other class of stores that furnish as logical an outlet for this class of appliances as the house furnishing store. The housekeeper is in the habit of coming to the house furnishing store for all her household purchases, which makes it easy for it to get all the business in this line if the proprietor cares to do so.

"The time to get control of this class of business is the present. Electrical dealers as a class at present are not merchants in the true sense. While they are anxious to sell these household appliances, they have not yet learned how to go after the business, how to arrange proper displays in their stores and windows, in a word, they have not yet learned how to sell. They are studying methods, however, and learning fast. If a house furnisher, who is already a merchant, wants this business, he must go after it now and establish himself in the field before his brother in the electrical line has time to get his bearings.

"During 1915 about ten million dollars' worth of electrical appliances were sold to the homes in the United States, an increase of about three million dollars over the previous year. This is an indication that the business is actually growing and is worth while handling. The profits are large and the tendency for the past two years is toward a maintenance of prices.

"Everything tends to show that the sale of electrical household appliances is good business, a growing business, and a business that the house furnishing stores throughout the country ought to handle."

It would be folly, therefore, to imagine that we can ostrich-like stick the "outside" store's head into the ground and think that he will not be seen.

It is equally unreasonable to believe that we can crowd electrical goods out of these stores as it would be for exclusive camera, hardware or picture stores to eliminate the sale of this class of merchandise from department or household goods stores, where people

trustfully trade and where the time payment plan and credit extension are additional allurements.

Furthermore, the non-electrical merchant, besides being equipped with merchandising experience, has learned the value of electrically trained salespeople and one concern, operating a chain of stores throughout California, is even employing a specialist to give advice in regard to the class of merchandise to be purchased and train all its salespeople in the selling of electrical merchandise.

These stores frequently make the electric shop appear in the role of the "blacksmith shop" referred to by Mr. Scobey, with its small stock, limited variety, poorly lighted and shabbily dressed windows, and poor attention and it is folly to think that the non-electrical stores do not make repairs or that they offer none but inferior merchandise. I venture to say that one can buy such goods in as many electrical stores as non-electrical ones in proportion to their number.

The non-electrical store, called N. E. store hereafter, knows the value of bargain sales, however, and will frequently purchase, in view of its large purchasing power, a large quantity of "non-association" but approved appliances, direct from the factory and offer the article at an attractive price. This is not price-cutting, but good business. In Los Angeles, at this very time, six electrical retail stores are selling as many types of irons at \$1.95 each and the ball in this direction was not started by a N. E. house. And, still worse, the various associations are not strong or active enough to stop this practice.

In San Francisco several "standard" articles are sold below "schedule" prices, one being sold at six different prices, at as many different places, which will allow the dealer 33 1-3 per cent profit, figured on the selling price, which many dealers believe to be a living profit.

And we furthermore know that the N. E. store, for reasons stated above, and others, is in a position to carry a larger variety of merchandise, which is a distinct selling advantage. A woman will ask for a H. P. or a U. or a W. or an A. iron and the store which carries all four types is more apt to make the average sale than the electrical storekeeper carrying but one or perhaps two types, largely because he deals with one jobber who represents but one factory and who, by giving the financially weak dealer credit, in the majority of cases, controls the policy and destiny of the store. So we have in most cities a W. or G. E. or H. P. or A. store, which is a distinct detriment to the dealer, but, under existing conditions cannot be altered. It is, however, a disadvantage under which the N. E. store does not have to labor, for he buys from any electrical or N. E. jobber or the factory direct.

Let us, for a moment, review a bit of history in this connection, so as to trace the entrance of the N. E. dealer into our "sacred" domain. I recall, how, as a manufacturer, sixteen years ago, I was forced to install an electrical department in Macy's department store, New York, in order to find an outlet for my electrically-heated appliances, there being no strictly electrical stores in New York at that time. This worked so well that other manufacturers sold this firm direct

much to their benefit and the disgust of the electrical fraternity. A little later a department of a similar nature was almost forced on the Wanamaker stores, and today more current-consuming devices are sold at this store, I understand, than in any electrical or N. E. store in New York City. And these and other large department stores are not price-cutters nor electrical blacksmith shops, but legitimate outlets for household appliances, electrically operated. If you want to find price-cutters look for them among the little electrical stores, struggling for existence, the store which cannot, from the protecting jobber, obtain a price, enabling him to live, just because he cannot buy in large enough quantities to entitle him to a fair margin of profit. Is it a wonder then, that so many electrical dealers succumb or are afraid to even make a real start? Let's try to find a remedy for this situation, it's equally important as window trimming and lighting. He says to the jobber: "Give me a better price and I'll sell more and therefore buy more," and the jobber replies: "You buy more and I'll give you a better price and then you'll sell more," a situation resembling the dog trying to catch his tail. I recall a similar condition years ago regarding the selling price of irons. We manufacturers had to set a price of \$7.75 on them because dealers wouldn't buy them in quantities. They couldn't sell more because the central stations wouldn't reduce the price for current. So the public simply balked. Someone had to give way and in the course of events, price per kw. and list prices of irons were reduced, more were sold and more were made and everyone was happy. But someone had to start making a concession and this applies also to the above situation.

As you remarked editorially some time ago: "Some electrical jobbers have been so short-sighted as not to recognize that their own success depends upon the success of their customers," and it is no wonder, everything considered, that you were forced to the conclusion that, "Electrical contracting has a poorer financial rating than almost any other line of business," which, of course, means the dealer, for seven-eighths of the electrical stores are operated by persons in the contracting business.

And, furthermore, you wisely state, in commenting on the danger of overstocking, that, "The jobber is perhaps more at fault here than the dealer for the jobber at least knows the limitation of demand, whereas the dealer only sees the quantity discount." Personally I can see no reason why an electrical dealer should not also be a contractor, especially as it may give him a lease on life, any more than we criticise a millinery store for making hats, kodak stores for printing pictures and furniture houses for installing carpets. On the other hand, I find it most logical for people to go to drug stores for vibrators, to furniture houses for vacuum cleaners, sewing machine stores for motors, sporting goods stores for flashlights, house furnishing stores for ranges, percolators and irons, all electrically-operated. The fact is, that the electrical dealer, who is just learning the merchandising game, is deluding himself into thinking that while he was asleep, the N. E. man was also a Rip Van Winkle, while, as a matter of fact, the old-time merchant was

slowly but surely acquiring his electrical education and experience.

A few more facts, now, in regard to price cutting. While discussing the merits of the Stevens Bill, Michael Friedsam, president of B. Altman & Co., New York, made the following significant suggestion: "Let the dealer cut the price of goods he wishes to discontinue carrying, provided the manufacturer or his jobber does not accept the offer to buy back at the price at which the merchandise was sold—an offer which the retailer shall be required to tender him. This would be an equitable, fair and reasonable provision." I wonder what our electrical jobber would say about the possible enactment of such a provision, suggested by a very successful merchant. And what are the "legitimate" jobbers doing or what can they do to stop price cutting, except to refuse to sell to such "unscrupulous" stores, in which case the goods may be obtained through other channels or inferior goods be placed on the market. Perhaps a remedy will be suggested. As a matter of fact I have personally sent out dozens of letters from a N. E. house to manufacturers calling their attention to price cutting, while the electrical dealers stewed and fretted and complained to the jobbers and discovered a new and warmer abode for the culprit. I have before me, also, a letter from an electrical dealer in San Francisco, which has a true ring to it, reading as follows:

"Enclosed is a list of changes I propose making on my retail prices due to increase cost of materials. I hope this information may be of value to you."

This letter was sent to six electrical and three non-electrical houses. But I have also, in contrast to this, a letter to a dealer from a purchaser, a state institution, which reads thus:

"In reply to your letter of —, will say that on competitive bids we find your range to be too high to consider and will have to give the business to the ———— (here was inserted the name of a legitimate jobber of S. F.) etc."

What has the jobber to say to this, and is such a procedure conducive to bettering the condition of the dealer or deserving of the eulogy Mr. Scobey bestows upon him?

With regard to ranges I wish to quote the following from Mr. Scobey's paper: "Here is an opportunity to get in on the ground floor and keep this business for ourselves, but prompt and vigorous action must be taken, before the house-furnishing and department stores get started with the line. He continues: "We can get the start on our friends, the enemy," and: "The central stations are virtually handing this business to us on a silver platter."

There need be no fear on the part of the electrical dealer that his "enemy" will accept this lemon even if it were offered, under present conditions, on a gold platter, studded with diamonds, for the wise merchant is too wide-awake to fool away his time or waste selling ammunition in an attempt to market an article which does not give him a living profit. Let the electrical "merchant" do a little figuring for himself, before he attempts to compete against central stations and jobbers in this field, the exploiting of which logically belongs to the former. And the more ranges the central stations sell, for at least a year, the more business it will bring to the contracting end of the dealer's business.

Many more concrete cases could be cited to bring home to the electrical dealer the all important facts that: The non-electrical store will continue to merchandise electrical appliances.

To avoid price-cutting and the flooding of the market with undesirable material it would be good policy to invite such merchants into an "Electrical Appliance Dealers' Association," an independent organization whose chief object it might be to preach the fallacy of price-cutting and the advantages of maintaining a standard of quality. To thus practice co-operation, instead of preaching elimination and discrimination. To institute an open forum for the frank and fearless discussion of your problems.

And I want you all to know that the electrical dealers and the jobbers and central stations as well, have no better friend and well-wisher than the undersigned, that the above discussion is impersonal and unprejudiced, that I bear no ill will toward any one and should welcome a further discussion of "our" problems in your own midst, for I believe, with Jas. H. McGraw, that: "The biggest commercial problem in the electrical industry remaining unsolved is that of merchandising."

Let us co-operate, friends, in its solution, for in the words of the immortal genius, Benjamin Franklin, uttered during the discussion of the Declaration of Independence: "Gentlemen, if we don't hang together, we may all hang separately."

Very truly yours,

MAX LOEWENTHAL.

San Francisco, Cal., July 24, 1916.

AN ELECTRICALLY EQUIPPED HOME IN THE SAN JOAQUIN VALLEY.

The Hammond "Delta Home" situated in the outskirts of the town of Byron in the San Joaquin Valley, on what is to be the continuation of the Mount Diablo boulevard, consists of nearly two acres. The house is a typical illustration of the modern transformations that electricity can accomplish.

Everything throughout the house is electric. There are heaters in every room and instantaneous water heaters in the bathrooms. The Bayonet heater attached to the boiler has one unit of 8000 kilowatts and another of 1100. Every wire in the house is in a conduit.

Cooking with electricity is a distinct success. The range runs about \$4.50 a month for a family of four. The kitchen is cool in summer and the preparation of a meal is a pleasure. In winter a heater in the kitchen keeps things nice and warm.

An automatic electric pumping plant is a feature of the yard. The cost of operation is nominal. The pumping plant also furnishes irrigation for the 9000 square feet of blue grass lawns and for the berries and vegetables.

As an instance of how cooking by electricity is receiving encouragement from all sides, actual count shows that about 175 electric ranges are now in use in the San Joaquin Valley at Tracy, Modesto, Oakdale, Manteca, and Byron. It is expected this number will be increased to 400 before the season is over.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.
(Continued.)

The fact is that although the present ground water plane over a considerable portion of Central Oregon is near the surface there is no reason to expect an abundant supply from that source for irrigation purposes. Central Oregon is a high, broad plateau region with a meagre supply of rainfall and with no immediately adjacent high mountain ranges, enjoying heavy rainfall, the drainage from which can readily reach the general body of ground waters underlying the distant interior plateau. The Cascade Mountains, for instance, pours all the heavy runoff from its easterly slope into the Deschutes River whence it is then carried on to the Columbia with practically no effect whatever on Central Oregon ground water conditions. The present shallow depths to, and apparent abundance of, central Oregon ground waters result from the fact that these waters now represent an accumulation of years which has practically never been tapped by man. If general pumpage irrigation were instituted over the entire tillable area where shallow depths to ground water now prevail, the supply would soon be exhausted. Pumpage irrigation from wells is limited by the amount of ground waters that can annually reach a rather restricted local area within which the well is located, and Central Oregon does not present favorable conditions for large supplies of that character.

The conditions in Central Oregon are not at all comparable with those which obtain in the Sacramento and San Joaquin Valleys in California for these latter valleys are comparatively narrow; they constitute the lowest great drainage basins in the state and are flanked by mountain ranges of good water yielding capacity, none of whose drainage is intercepted and diverted away from these valleys but all of which, in numberless streams, is carried across and through them. Our Willamette Valley presents conditions more nearly comparable to those of California, and in this valley we may anticipate abundant supplies of ground water ready at hand whenever it becomes desirable to develop them by pumpage.

It may be said finally that the irrigation pumpage possibilities in Central Oregon are not as extensive as many suppose, particularly as measured by power requirements, and what is more pertinent to this particular inquiry, to the extent that they do exist they can be more economically served as part of, or incidental to, local gravity project developments, or by power which could be developed on the Deschutes River, which is a much nearer source of supply, and possibly by power which can be developed on the Chewaucan River which is a still nearer source of supply. It appears from investigations already made that power can be developed about as cheaply on the Deschutes as on the Columbia River, and besides being much nearer the central Oregon district it would have the further advantage of being more easily financed because of the lesser initial investment required. It is also likely, however, that the annual operating cost for a Deschutes power plant would be somewhat greater per unit of power output than would that of the Celilo plant because of the lesser magnitude of the former.

Willamette Valley.—This district was not assigned for specific consideration in connection with this investigation because of its very uncertain status in respect to irrigation and more particularly pumpage irrigation. Certainly the Willamette Valley is quite outside those portions of Oregon ordinarily classed as arid or semi-arid and its need for irrigation is therefore not immediately apparent. Despite its 36 in. of annual rainfall, however, it has an average rainfall of less than 3 in. during that season of the year which, by reason of its warmth and abundant sunshine, is best adapted to active plant growth, to wit: the months of June, July and August. So small an amount of summer rainfall is less than that of some of our so-called arid districts where irrigation is recognized as a prime necessity, and it at once suggests that here too irrigation might be practiced with profit as is being done, for instance, in the valley of the Po in northern Italy where both the annual and the summer rainfall is greater than that of the Willamette Valley.

The amount of irrigation water required would be from 12 in. to 18 in. per season, and there only remains to be proven that the increased crop returns would justify the cost of the irrigation development. While the writer is confident that this class of irrigation development can be justified and will ultimately be consummated in many districts, he recognizes that the case has not yet been fully proven for the Willamette Valley. He also recognizes that full and frequent proof must precede its general acceptance by the public and that any important development of irrigation along that line must await such acceptance and approval by the public, all of which will require time and education.

So far, too, as the proposed Celilo power project would be concerned in this irrigation development it must be proven that the irrigation water will be supplied by pumpage. Undoubtedly abundant ground water supplies for pumpage can be found in the Willamette Valley, as was pointed out in a previous section, but undoubtedly, too, large gravity supplies are available and at low cost, and practically all of these must be exhausted before any general demand or justification for irrigation by pumpage will arise.

A far more likely demand for Celilo power with respect to agriculture in the Willamette Valley will be in connection with drainage and the reclamation of wet lands. No data are now available to me for determining the area that might thus be reclaimed nor the amount of power required but the very low lifts usually involved in that class of development would indicate that the aggregate power demand would not be great. It might not, on its own account, be sufficient to justify long distance electric transmission but with the general commercial power that will be in demand throughout the Willamette Valley such transmission would be justified and cheap power would thus become available for irrigation purposes.

Other Areas Excluded.—Other areas of good agricultural land which came under my observation but which were finally not regarded as tributary to Celilo power on account of cost were as follows: Moses Lake District which now has some 900 h.p. in gasoline engine pumping plants and which may ultimately require 2000 h.p. to reclaim from 12,000 to 20,000 acres of land, Moses Lake, at lifts varying from 40 ft. to 150 ft.

Quincy Valley is an extensive plateau area of nearly a half million acres, which will ultimately be reclaimed by gravity but which, pending that development, is now practicing and will continue to practice some irrigation by pumpage from wells. Lifts will vary from 50 ft. to 300 ft., and it is believed that this demand, by reason of water limitations, will never exceed 3000 h.p.

Crescent Bar District on the Columbia River just south of Trinidad on the Great Northern Railway, may ultimately require about 200 h.p. to reclaim 1000 acres, about one-half of which is now under cultivation and served by a steam plant.

Cohassett District on the west shore of the Columbia River between Cohassett Station on the C. M. & St. P. Railway and Whiskey Dick Canon, may ultimately require 500 h.p. to reclaim 3000 acres at lifts ranging from 50 to 100 ft.

Richmond District on the west shore of the Columbia River immediately south of the main line and paralleling the Hanford branch line of the C. M. & S. P. Railway, may ultimately require 500 h.p. to reclaim 3000 acres, several hundred acres of which are already under cultivation.

It has been estimated that for all of the above districts with the possible exception of the Richmond District, the cost of Celilo power would be in excess of one-half cent per kilowatt hour and that some other form of power or electric power derived from some nearer source would prove more economical.

Existing Pumping Projects.—Along the entire course of the Columbia River from the proposed generating station at Celilo Falls to the northerly limit of proposed transmission at Beverly, private pumping plants are being operated, these ranging from the small gasoline plant of the individual farmer serving from 10 to 100 acres to the larger electric power pumping plants owned by corporations and serving several thousand acres. Among these latter are the plants of the Beverly Land Company, Hanford Irrigation Company, Pasco Reclamation Company, Burbank Company, Altalia Land Company, and the Northern Pacific Irrigation Company.

All of these companies will continue to require power, with the possible exception of the Northern Pacific Irrigation Company, which may ultimately be served by gravity supply from the proposed Yakima Valley Irrigation Project. The present cost of power to all of these companies is far in excess of that at which Celilo power could be delivered to them and all of them, except the Northern Pacific Irrigation Company, have therefore been included as possible users of Celilo power.

It is an interesting fact in connection with practically all of these larger corporate enterprises that the annual charge to the water user for maintenance and operation is appreciably less than the actual cost of pumpage and not infrequently is less than the cost of power alone. The water user and the public generally are not aware of this fact and are too prone to believe that the irrigation companies are reaping large profits from the annual maintenance and operation charge, whereas the very reverse is the case. The companies, of course, have generally provided for this operating loss in fixing the price of their land, thus creating

a situation that is misleading, and the water users will, therefore, not come to a full appreciation of actual operating cost until they are themselves required to operate the pumping plants.

Resume and Conclusions.—By reference to Fig. 40 it will be noted that for all the irrigation pumping projects listed as possible future consumers of Columbia River power there are embraced some 635,000 acres of irrigable land of which amount 25 per cent is in the state of Oregon and about 75 per cent in the state of Washington. It will be noted too, that the motor capacity required for this aggregate development is 396,000 h.p. and that the installation required at the generating station will approximate 255,000 kw.

The average price at which it is estimated Columbia River irrigation power can be delivered to the motors at the pumping stations is about \$10 per h.p. of connected load per irrigation season or about 0.35 cents per kw.-hr. of actual power consumption, this being about one-third the present average rates for such power. Such reduction in power rates must inevitably give impetus to the industry of irrigated agriculture by pumping and the extent to which the above estimates of gross acreage and gross power demand must be varied will depend largely upon whether or not the power rates herein assumed are actually achieved.

In this connection it should be stated that the above power rates are based upon the assumption of the transmission of large blocks of power and if the irrigation development is so slow or so restricted as not to require fairly large amounts of power then would the power rates need be increased. If on the other hand the power rates are decreased, whether from a policy of agricultural subsidy or because of an actual lesser cost of producing same, then could higher lifts be achieved than herein contemplated and a greater area of land be thus reclaimed. It should also be stated that commercial load demands may compel the construction of transmission lines that would render feasible some of those smaller irrigation projects which have been excluded because their limited size did not justify electric transmission on their account alone, and this would tend slightly to increase both area and power requirements.

Viewed from any angle it would appear that the irrigation pumping possibilities along the Columbia River valley, upon a basis of cheap power, are of sufficient magnitude to tax any auxiliary capacity that might economically be provided by the proposed Columbia River power development. In other words, there may be created such a demand for primary power, i.e., all year power required for manufacturing and general industrial purposes as to leave no considerable physical space available for auxiliary power house construction at the proposed power site. If the Priest Rapids and Benton Projects were excluded as not tributary to Celilo power and if the Castle Rock Slope area was appreciably sealed down or even entirely eliminated as being less economical than a gravity development, there would still remain a demand for the installation of at least 80,000 kw. of auxiliary power for irrigation purposes at the Celilo generating station, which in itself is larger than any single installation now on the Pacific Coast.

(To be concluded next issue.)

HOW—GENERAL FACTS, FIGURES AND THEORY OF CURRENT INTEREST

HOW TO COMPUTE THE HORSEPOWER RATING OF YOUR AUTOMOBILE.

BY ROBERT SIBLEY.

It is found by reference to collected data that for the safe operation of an automobile the piston speed should never exceed 1000 ft. per minute.

On this assumption the Association of Licensed Automobile Manufacturers have agreed upon a rating of the indicated horsepower developed in the engines of an automobile simply by taking account of the number of engine cylinders and the diameter of each cylinder.

The indicated horsepower of any heat engine, whether it be steam engine, gas engine, Diesel oil engine, air compressor or automobile engine may be computed from the well-known formula:

$$H. P. = \frac{PLAN}{33000} \quad (1)$$

In which P = mean effective pressure.

L = length of stroke in ft.

A = area of cylinder bore in sq. in.

N = number of working strokes per min.

If S = the piston travel per min. in ft.

$$\text{Then } N \times 4 \times L = S, \text{ or } NL = \frac{S}{4}$$

$$\text{And } A = \frac{\pi d^2}{4} \text{ in which } d \text{ is piston diam. in inches.}$$

$$\therefore \text{ in the formula } H. P. = \frac{PLAN}{33,000}, \text{ we have}$$

by substituting for NL and for A,

$$H. P. = \frac{PLAN}{33,000} = \frac{P \times \frac{S}{4} \times \frac{\pi}{4} d^2}{33,000} = \frac{\pi}{16 \times 33,000} P d^2 S$$

Experimental data:

A long series of experiments have established the fact that the mean effective pressure P developed in an automobile engine cylinder under full load conditions is such that the factor

$$\frac{\pi}{16 \times 33,000} P \text{ in the}$$

above expression may be replaced by a factor C

in which for the best engines C has a value 24,200,000

of 12,950, for the normal engine 9786, and for the worst type of engine 7960.

Hence we have for the indicated horsepower of an automobile engine that

$$H. P. = \frac{\pi}{16 \times 33,000} P d^2 S = \frac{C d^2 S}{24,200,000} \quad (2)$$

This shows us that where we base the limit of engine development in the speed of the piston that it is not necessary to know anything about the auto engine save the diameter of the cylinder and the number of cylinders in order to compute the rating of the automobile engines.

Formula for Rating of Autos.

Thus the Association of Licensed Automobile Manufacturers having agreed that 1000 ft. per min. shall be the limit of piston speeds we have for the normal machine in which C = 9786 and n = number of engine cylinders.

$$H. P. = \frac{9786 \times d^2 \times 1000}{24,200,000} n = \frac{n d^2}{2.50} \quad (3)$$

Illustration:

A Ford automobile has four cylinders and each cylinder works on the four cycle principle. The cylinder is $3\frac{3}{4}$ in. bore. What is indicated h.p. rating according to Association of Licensed Automobile Manufacturers?

$$H. P. = \frac{4 (3.75)^2}{2.5} = 22.5$$

FACTS AND FIGURES OF CURRENT INTEREST

Public spirited civic bodies on both sides of San Francisco Bay are urging the serious consideration of the construction of a mammoth bridge to connect San Francisco and Oakland. It is estimated that the bridge would cost \$22,000,000, be five and one-half miles in length, and constitute the greatest undertaking of its kind ever attempted. Estimates of tolls from the bridge traffic, underbidding the present ferry system traffic, show that the bridge would pay for itself within fifteen to twenty years.

* * *

There are about one hundred and ninety-one million domestic animals in the United States, which includes about twenty-one million horses, valued at \$2,300,000,000. The mule represents \$560,000,000.

* * *

In California, the 190,000 automobiles contribute annually one-half their total fees for highway maintenance which yield annually about one million dollars for that purpose.

* * *

Railroads are the largest users of water in the country. The daily water consumption of the Illinois Central, for instance, is placed at 1,950,000,000 gallons, at a daily expense of \$100,000.

* * *

Russia's production in crude petroleum last year was sixty-nine million barrels, a gain of two million barrels in a year.

* * *

Fire losses are on the decrease. The total losses by fire last year in the United States and Canada were \$182,836,000, as compared with \$235,591,000 the previous year.

JOURNAL OF ELECTRICITY

POWER AND GAS

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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One effect of the European war has been the substitution of iron for copper as an electrical conductor.

Skin Effect

Consequently "skin effect," once a subject of purely theoretical interest, has now become a matter of practical concern. The extent to

which iron has replaced copper has depended upon the scarcity of the red metal. In Germany, the replacement is reported to have been most marked, as little copper is available for electrical purposes. In America, iron is being used in place of copper only in special instances where the high cost of copper makes its use prohibitive or where high conductivity is not essential.

Skin effect is the crowding of an alternating current to the surface of a wire due to the interior eddy currents resulting from the magnetic flux within the conductor. It causes the effective resistance to be greater for an alternating than for a direct current. With copper or aluminum this effect is negligible except in extremely large cables or at high frequencies. With iron and steel conductors, as well as with bi-metallic wire, this factor must be taken into consideration.

Its calculation is extremely difficult, if not impossible, in magnetic conductors. Experiments have been few and far between and erroneous empirical formulas have been carelessly accepted at their face value, thus compounding confusion.

To bring order out of this chaos has been a labor of love to Mr. Clem Copeland, the result of whose extensive researches is initiated in this issue. To many readers the development of the theory of the subject may prove too formidable for intelligent study, but to most of them the practical curves which Mr. Copeland derives should be of inestimable service.

Even the house-wiring contractor will find many copper circuits which are rarely worked at anywhere near the permissible voltage drop, especially where only a few Mazda lamps are supplied with current. There are likewise many lightly-loaded distribution lines where copper can be replaced to economic advantage by iron or steel wire. In long transmission spans, also, it is occasionally advisable to use steel conductors because of the greater strength. Furthermore, high effective resistances are necessary for lightning protective reactances and choke coils to prevent destructive high frequency surges.

In the United States the determination of when and where to use iron and steel conductors is one of dollars and common sense. The temporary saving effected by the cheaper wire should not outweigh the permanent cost of the energy lost by its utilization.

While Mr. Copeland's exhaustive investigations are still incomplete, they form a most valuable contribution to electrical technology. They expose several popular fallacies and point out the incorrectness of commonly-accepted formulas. They indicate one respect in which even the terrible war may eventually benefit humanity by pointing out economies which may be universally practiced in the future. Recently a number of authors have made the error or neglected the proximity effect and, have proposed the use of curves which are in no way adapted to the purpose.

Price-cutting is the bane of retail selling. Strangely enough the term "retailer" comes from an old French word meaning to cut again.

Price Maintenance Whereas, originally, it referred to store keepers who bought cloth by the piece and then cut off smaller quantities for sale to customers, it now ironically seems to apply only to the cutting of prices. The small retailer, ordinarily, might not be a price cutter were it not for competition from department stores and from the prevalent belief that price maintenance is illegal.

The department store at first used cut prices as a bait to lure trade in the hope that the profit from other goods would compensate for the loss in handling the standard articles whose prices were cut. As a result, the legitimate dealer cannot afford to sell those articles and the price cutter finally finds that the consumer's confidence in them has been destroyed and so he also ceases to handle them. The market for the manufacturer's product is thus destroyed and the consumer is unable to buy many meritorious articles. Furthermore the consumer does not benefit from this predatory practice as it increases the cost of distributing goods and so adds to the cost of living.

Keensighted business men have good reason to believe that the day of the old-time department store is waning. Once the most highly developed form of retail selling, it is now becoming top-heavy. In large cities the expense of operation is close to thirty per cent. Several large department stores have recently failed, due to high overhead, excessive rents and the discriminating buyer's preference for the specialty shop. It is a universal law of nature that centralization is invariably followed by de-centralization, to be succeeded in turn by a new grouping, and thus the cycle is repeated indefinitely.

This condition has not been overlooked by the department stores themselves, the most modern of which are no longer a series of departments under one management, but rather a store or stores, each department being an independently managed specialty shop. Whether the convenience of several shops under one roof, will appeal to the purchaser more than the isolated shop is problematical.

This subject is one of several symptoms of disease in electrical retail selling which are discussed without gloves elsewhere in these columns by Mr. Max Loewenthal, a man whose wide experience eminently qualifies him to write. He brings up several mooted questions which may invite comment from Journal readers.

The main point to be emphasized, as also brought out by Mr. M. L. Scobey last week, is that aggressive action is essential on the part of the retail electrical dealer.

More fundamental to the success of the business, however, than any economies that may or may not be effected by department store centralization is the principle of one price to all. Price maintenance is a necessity to modern business and as such is not frowned upon by the government. It reduces the waste caused by trade friction, lowers the cost of distributing goods and equalizes competitive conditions. It substitutes confidence in business for the old policy of "let the buyer beware," and the inefficient and time-consuming Chinese method of haggling.

In the course of a recent hearing before the Senate committee on interstate and foreign commerce, Paul H. Nystrom, well known as a former professor of economics and at present a practical retailer, argued that the Supreme Court does not prohibit price maintenance in general, but only that kind which is most economical to the producer, the dealer and the public—the advertising and maintenance of a standard price on trade-marked goods. The chain store is a legal and effective means of accomplishing the same result, but requires large capital and great executive ability.

A remedy for the present undesirable condition was contained in the Stevens bill, which failed to pass the last Congress. The same principles are involved in the Ayres bill now before the House of Representatives, its purpose being "to prevent discrimination in prices and to provide for publicity of prices to dealers and to the public."

Until some such legislation is enacted so as to protect price cutters against themselves reason would at least suggest that the electric retailer take a sensible view of the situation and voluntarily maintain a price which gives him a living profit.

There is nothing more confusing than present methods employed in rating automobiles, and yet every automobile owner should be familiar with a quick and ready rule for arriving at this result.

The Rating of Your Automobile

On another page of this issue will be found a method now universally employed by licensed automobile manufacturers for the rating of their product. Briefly put the rating of any automobile in indicated horsepower developed in the engine cylinders may be ascertained by squaring the cylinder bore in inches and multiplying by the number of cylinders comprising the automobile engine equipment. When this product is divided by two and one-half the rating is at once ascertained. That horsepower is thus independent of the pressure, the length of stroke, and the number of strokes per minute becomes true in the automobile engine due to the fact that the safe limit of piston speed is found to be at one thousand feet per minute. By substituting this limitation in the well known formula for heat engines used in computing indicated horsepower and also by substituting average working pressures prevailing in automobile practice, the formula for rating automobile engines is at once deduced.

It is to be remembered that the result so obtained represents average conditions. Better machines may develop higher output and machines below the average less output. Again when speaking of indicated horsepower developed it must be remembered that this power is that actually prevailing in the engine cylinders and not that delivered at the crank shaft, the transmission gearing or at the rim of the driving wheels. In other words the power actually delivered at the crank shaft is about 80 per cent of the total indicated power, while that finally delivered to the wheel rim is far less.

The formula is, however, extremely useful in computing power rating for state, city or county license fees and is quick and easy of application.

PERSONALS

W. Todd and **W. B. Lewis**, salesmen with Western Electric Company, were at San Francisco this week.

C. R. Hunt, Pacific Coast manager Robbins & Myers Company, has returned to San Francisco from Los Angeles.

Jos. B. Kahn, superintendent of the Alameda municipal lighting plant, has returned from a vacation at Lake Tahoe.

H. Brewster Hall, Pacific Coast manager Pass & Seymour, Inc., is making a six weeks' trip through Southern California.

M. C. Wright, electrical contractor at Eureka, Cal., and **E. H. Kuntz**, electrical contractor at Arcata, Cal., have returned home from a visit to San Francisco.

J. L. White has succeeded **A. Norman** as manager of the Willamette Valley district of the Oregon Power Company at Albany, Wash.

L. A. Somers, manager industrial department Westinghouse Electric & Manufacturing Company at San Francisco, has returned from a two weeks' vacation at Capitola.

W. C. Wurfel, Pacific Coast manager Westinghouse Lamp Company, is spending his vacation with his family in southern California.

C. E. Thompson has joined the San Francisco force of the Westinghouse Electric & Manufacturing Company as treasurer's accounting representative.

W. S. Berry, sales manager Western Electric Company at San Francisco, has returned to his desk from a three weeks' vacation in Sonoma county, Cal.

Mr. George B. Muldaur, formerly connected with the Society for Electrical Development, is now traveling secretary of the National Electric Light Association.

Geo. L. Hedges, engineer Kelman Electric & Manufacturing Company, Los Angeles, Cal., has been transferred to the grade of member of the American Institute of Electrical Engineers.

H. S. Eates of the Westinghouse Lamp Company, Los Angeles, returned from a two weeks' trip through Idaho, where he visited his home in Gooding. He reports business very prosperous in the southern part of the state.

W. C. Johnson, sales engineer with the Westinghouse Electric & Manufacturing Company at San Francisco, acted as captain of Company I of the "rookies" from the business men's Monterey encampment during the preparedness parade at San Francisco.

Geo. D. Longmuir, local manager for the Pacific Power & Light Company, at Pasco, Wash., is expected to return from a six months' trip East about August 10th. **C. R. Young** of the same company's Portland office, is acting as local manager in the interim.

Garnett Young, Pacific Coast manager Telephone Electric Equipment Company, has started on an extended trip to visit the eastern factories he represents. He goes east by way of Los Angeles and expects to attend the Pacific Coast Electrical Supply Jobbers' meeting at Hayden Lake, Idaho, on his way back.

C. P. Gordan, electrician, Port of Seattle, Seattle; **H. S. Haley**, of Leland & Haley, Holbrook Building San Francisco; **Austin L. Kimball**, Otis Elevator Company, Seattle; **W. J. Mackay**, switchman Pacific Telephone & Telegraph Company, Seattle; **John Spasoff**, substation operator Pacific Gas & Electric Company, San Rafael, Cal.; **L. H. Telfer**, electrical superintendent Great Northern Railway, Wellington, Wash., and **J. H. Wooll**, construction engineer Sierra &

San Francisco Power Company, San Francisco, have been elected associate members of the American Institute of Electrical Engineers.

W. A. Brackenridge, vice-president and general manager Southern California Edison Company of Los Angeles, was at San Francisco during the past week.

John A. Britton, chairman of the San Francisco general committee for America's Electrical Week, has appointed the following committee of arrangements to prepare plans for the celebration: **F. H. Leggett**, Western Electric Company; **R. M. Alvord**, General Electric Company; **E. B. Strong**, Journal of Electricity, Power & Gas; **S. V. Walton**, Pacific Gas & Electric Company, and **Paul C. Butte**, Butte Engineering & Electric Company.

B. P. Legare, chief engineer United Railroads of San Francisco, was marshal of the Engineers' Club division in the preparedness parade on July 22d. His aides were: **M. M. O'Shaughnessy**, **A. A. Hanks**, **C. W. Merrill**, **W. A. Cattell** and **Geo. L. Dillman**. The captains were: **H. H. Wadsworth**, **H. W. Crozier**, **W. C. Hammatt**, **E. B. Bumsted**, **Geo. R. Murphy**, **R. A. Gould**, **C. T. Hutchinson**, **H. L. Hale**, **A. E. Chandler** and **C. H. Snyder**.

H. V. Carter, having disposed of his holdings in the Pacific States Electric Company, has resigned as president and general manager, after seven years' service, during which period there has been a steady growth in the volume of sales and standing of the company. Because of Colonel Carter's resignation the board of directors has elected **T. E. Bibbins**, president, **W. L. Goodwin**, vice-president in charge of sales, **S. B. Anderson**, treasurer; and **G. I. Kinney**, secretary. Announcement is made that there will be no change made in the general policy of the company.

Thomas E. Collins, of the Pacific Electric Manufacturing Company, was marshal of the Electrical Development and Jovian League division of the preparedness parade at San Francisco, July 22nd, and **E. A. Wilcox**, Great Western Power Company, was assistant marshal; **W. L. McKinley**, Sierra & San Francisco Power Company; **E. M. Cutting**, Edison Storage Battery Company; **W. M. Shepard**, California-Oregon Power Company; **A. Youngholm**, Electric Railway & Manufacturers Company, were aides. **T. E. Bibbins**, of the General Electric Company, was the honorary color-bearer. The captains were **A. H. Halloran**, Journal of Electricity; **Miles F. Steel**, Benjamin Electric Manufacturing Company; **H. E. Sanderson**, Bryant Electric Company; **C. L. Chamblin**, California Electrical Construction Company; **W. D. Tardiff**, Electric Appliance Company; **A. Younghelm**, Electric Railway & Manufacturers Supply Company; **E. D. Shreve** and **F. E. Boyd**, General Electric Company; **M. S. Orrick**, Western Electric Company; **W. R. Dunbar**, Westinghouse Electric & Manufacturing Company; **J. P. Cowperthwaite**, Great Western Power Company, and **F. D. Baker**, Sierra & San Francisco Power Company. The section had nearly 300 men in line.

OBITUARY.

Charles W. H. Kirchhoff of New York, who for twenty years was editor of Iron Age, died at his summer home at Asbury Park, New Jersey, July 23, 1916. He had been a special agent of the United States Geological Survey and president of the American Institute of Mining Engineers. He was born in San Francisco in 1853 and was graduated from the Royal School of Mines at Clausthal, Germany.

MEETING NOTICES.

A joint convention of the Northwest Electric Light & Power Association and the American Institute of Electrical Engineers, is to be held at the New Washington Hotel, Seattle, Wash., September 6, 7, 8 and 9, 1916.

FINDINGS OF THE PUBLIC SERVICE COMMISSION OF OREGON.

The Yamhill Electric Company and Yamhill County Mutual Telephone Company, public utilities within the meaning of Chapter 279 of the General Laws of Oregon for the year 1911, own and operate electric and telephone plants, respectively, in Yamhill county, and insofar as this controversy is concerned, are particularly the owners of certain electric and telephone lines in Dayton, Oregon.

The commission recently issued an order to the Yamhill Electric Company and the Yamhill County Mutual Telephone Company to share equally the expense of removing extremely hazardous conditions existing at First and Ferry streets, and on Third street, Dayton, due to the interlacing of wires. The work must be commenced immediately upon service of a copy of the findings of the commission and completed on or before 20 days thereafter.

NOTES OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has issued an order authorizing the West Riverside Canal Company, of Riverside, to issue seven shares of stock of the par value of \$50 per share for the purpose of qualifying directors.

The commission has issued a supplemental order authorizing the Western States Gas & Electric Company to withdraw from the Girard Trust Company of New York \$10,506.38 representing 75 per cent cost of additions and betterments in May, 1916.

The commission has authorized the Fresno and Interurban Railway Company to issue \$149,700 first mortgage six per cent 25 year bonds, \$10,936.27 face value notes and \$8100 par value capital stock.

The commission has authorized Pomona Valley Telephone & Telegraph Union to invest as working capital \$26 425.88.

The commission has authorized the Midland Counties Public Service Corporation to issue one year promissory notes for \$13,957.54 to renew outstanding notes.

The commission has authorized the Southern California Gas Company to issue promissory notes for not more than one year for \$49,789.90 to renew outstanding notes.

The East Oakland Water & Electric Company has applied to the commission for authority to borrow \$2000 for extensions and improvements to its distributing system.

NEW CATALOGUES.

A two-color, six-page folder describing the new C-H Candle Length Socket has just been issued by The Cutler-Hammer Manufacturing Company of Milwaukee.

A new pamphlet is just out describing the Hubbell Quick Catch wall and ceiling sockets. This socket meets its maximum usefulness for side wall lights designed on the imitation candle style.

Benjamin Electric & Manufacturing Company are distributing a new bulletin on industrial signal systems for factory calls and fire alarms. These employ either motor-driven or vibrating forms, complete wiring diagrams are shown.

Catalogue 11 from The Trumbull Electric Manufacturing Company of Plainville, Conn., comprises an illustrated and descriptive price list of switches, panels, boards, boxes, and other wiring supplies. Its use is greatly facilitated by a convenient center-opening thumb index giving ready access to desired information.

Bulletin number 45603 just issued by the General Electric Company, describes that company's Graded Shunt Resistance Multigraph Lightning Arresters for Alternating Current Constant Potential Circuits. This description is contained in a pamphlet of thirty-two pages, which is illustrated by descriptive diagrams and half-tone illustrations.

The Cutler-Hammer Manufacturing Company of Milwaukee, has just issued an eight-page booklet describing the C-H line of Electrically Heated Candy Manufacturing Appliances. It is claimed that the cleanliness, efficiency and economy of electricity combined with the improved quality and quantity of the product makes electric heat not only desirable but necessary.

The Cutler-Hammer Manufacturing Company of Milwaukee has just issued a small four-page folder describing the new C-H 7700 Line of "Standard" Interchangeable Plugs and Receptacles. The plugs and receptacles described are referred to as "Standard" because they are constructed on "Standard" specifications agreed upon by six large manufacturers of electric wiring specialties.

A large two-color, eight-page folder describing Cutler-Hammer Machine Tool Controllers was distributed to master car builders at their annual June convention at Atlantic City. The new folder is issued by The Cutler-Hammer Manufacturing Company of Milwaukee. The folder describes Machine Tool Controllers in three classes, as Plain Starting, Speed Setting, and Speed Regulating controllers.

The specialties department of the Cutler-Hammer Manufacturing Company of Milwaukee, has just published for distribution a new edition of its Automobile Lighting Switch booklet. The new edition states that there are now more than a million C-H switches in use on Packards, Overlands, Studebakers, Buicks, Detroit-Elctrics, Haynes, Pullmans, Fords and many other cars equally well known.

Push-Button Press Control is the title of a new four-page newspaper size broadside just issued by the Printing Equipment Department of the Cutler-Hammer Manufacturing Company of Milwaukee. The new folder describes the Kohler System of Push-Button Press Control which the folder states is now in use in 80 per cent of the printing establishments of this country. The folder is of newspaper size and is built up in columns very similarly to the newspapers.

BOOK REVIEW.

Principles of Electrical Design, by Alfred Still; 365 pp.; 6x9 in. Published by McGraw-Hill Book Co., New York, and for sale by Technical Book Shop, San Francisco. Price \$3.00.

In recent years there have appeared from various publishing houses many books claiming to cover the principles of electrical design. Too often the author has forgotten that he too, was once but a mere inexperienced student without any sense of proportion. As a consequence the student has found in following the text assigned in such instances that frequently bewilderment followed his attempts to carry out in class assignments the ideas the author was trying to convey. Here is a work which, though covering 365 pages of reading matter frankly admits that as a reference book for the designer the text is incomplete. Indeed it is incomplete also as a means of giving the student what he is supposed to get from a course in electrical design, for the simple reason that no art can be mastered by the mere reading of a book. As a reference text, however, for a course of lectures on the subject of electrical design, the book is excellent. The author clinches the proper psychological attitude for the student designer to assume from the start. His introductory chapter is full of wholesome, helpful suggestions as to how the designer should proceed with his work and the mental attitude he should assume to become a successful designer or a successful engineer. Next follow in sequence detailed discussions of theory and problems in design covering electromagnets, continuous current generators and alternating current generators. The painstaking care with which the author has carried out his illustrative problems in design are very helpful. The author is professor of electrical design at Purdue University and an engineer of wide practical experience.



NEWS NOTES



ILLUMINATION.

THE DALLES, ORE.—Mayor Anderson, in his message, urges the advantages of a municipal lighting system.

SAN RAFAEL, CAL.—The board of supervisors will receive sealed bids up to August 8th for installing lights in the Laverne Lighting District.

PARLIER, CAL.—Sealed bids will be received up to August 9th for installing the necessary apparatus for lighting the Del Rey Lighting District.

BOISE, IDAHO.—The Harrison Boulevard Association has adopted a resolution to install 17 250 candlepower lamps in the proposed park on Harrison boulevard.

GOLDFIELD, NEV.—J. B. Fayant has applied to the county commissioners for a gas franchise in this city. The application will be heard on August 9th.

SAN ANSELMO, CAL.—It is expected the town trustees will soon pass a resolution of intention ordering the installation of electroliers along San Anselmo avenue.

WALLA WALLA, WASH.—The county commissioners have awarded the contract for electric fixtures for the court house to the Cascade Electric & Power Company of Seattle at \$4000.

BAKER, ORE.—A fund of more than \$1000 has been raised towards a system of ornamental street lighting in Baker. The council will next take up the question of which type to select.

SANTA PAULA, CAL.—The committee on street lights has made a report to the chamber of commerce recommending that Marbelite posts, manufactured by the American Cements Products Company be used.

SPOKANE, WASH.—Plans have been adopted for installing, operating and maintaining for a period of ten years, an ornamental street lighting system on Main avenue, from Division to Monroe streets.

LOS ANGELES, CAL.—Ordinances have been adopted by the city council for lighting Wilshire Boulevard between Park View street and Arden boulevard and also for lighting Park View street between Sixth and Seventh streets.

TUCSON, ARIZ.—Installation of ornamental lights on South Stone avenue must be made next year from revenue funds as the bond issue for that purpose is exhausted. It is estimated that \$3000 will be necessary to complete the system on the paved streets.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has offered to furnish 110 arc lights of 250 candlepower along the main drive of Golden Gate Park, from Stanyan street to the beach, three miles, at a cost of 13c per lamp per night. The posts are to be ornamental and 12 ft. high.

LOS ANGELES, CAL.—At a meeting of the board of supervisors a contract and bonds for improvement work in the Graham Lighting District were approved and an order was made requesting the chief mechanical engineer to prepare plans and specifications for improvement work in the Bonita Meadows Lighting District.

IRRIGATION.

BAKER, ORE.—Within the next 30 days, Contractor J. A. Hoskins will start work on a \$10,000 private irrigation project for the Thomsen Cattle Company of Hereford on upper Burnt River. The company has an excellent reservoir site and will impound the waters of several small streams.

LAGUNA, CAL.—Users of water in the Laguna and Riverdale conservation districts are preparing to take advantage of the proposed building of the Pine Flat storage. Petitions

will ask the supervisors to call an election to vote for the establishment of an irrigation district to include these points.

SUISUN, CAL.—A plan for an irrigation district to take water from the San Joaquin River several miles north of Rio Vista and conduct it in a westerly course toward Suisun covering a large area of farm lands is being promoted. A preliminary survey has been made.

KLAMATH FALLS, ORE.—Twenty-nine owners of land in the Wood River Valley, north of Fort Klamath, in the northern part of Klamath county, have been granted clear and undisputed water rights on Anna Creek, according to certificates received from State Engineer Lewis. This controversy has been one of long standing.

CHEHALIS, WASH.—Filing of 18 waterpower rights in the office of the Lewis county auditor here by the Valley Development Company of Portland would indicate that the concern plans at an early date to begin work developing the Packwood holdings which it owns and on which about 11 years ago a large sum of money was spent in engineering.

VISALIA, CAL.—The Kaweah Canal & Irrigation Company, a new organized corporation, intends to store water from Yokohl Creek and the upper Kaweah tributaries with which to irrigate considerable land in Yokohl Valley and west, but properly to do so, according to the engineers, the company must have a certain reservoir situated on the C. H. Lee place in Yokohl Valley. Lee refused to sell the land, 160 acres, and suit has been begun to condemn it for the irrigation reservoir for the canal.

OROVILLE, CAL.—Harry Cauthard, superintendent of the construction work on the Western Canal Company's property, has been in the city for the purpose of conferring with officials of the canal company and the Great Western Power Company relative to the extension of water service to Thermalito. The Western Power Company has a large power plant at Las Plumas and the water that is received there from Lake Almanor could be turned into a ditch and carried over the foothill region to Thermalito.

LINDSAY, CAL.—Bids for the construction of the Lindsay-Strathmore irrigation system have been taken. The work to be done embraces the construction of 37 wells and well pumping plants, 9 miles of banded wood stave pipe, 3¼ miles 60 in. reinforced concrete pipe or 6½ miles of 48 in. continuous stave redwood pipe, 12 miles of concrete lined ditch, 85 miles riveted steel pressure pipes or reinforced concrete pipe, and two high head pumping plants with an aggregate of 2250 h.p. in motors directly connected to the centrifugal pumps. The maximum time allowed for the completion of the entire work is May 1, 1917.

TRANSMISSION.

BOISE IDAHO.—A petition has been filed with the public utilities commission in the matter of the Southern Idaho Water Power Company to make an extension of its line Rockland.

SAN BERNARDINO, CAL.—The board of supervisors of this county will receive sealed bids up to August 14th for a 50 year franchise over certain public highways as applied for by the Southern Sierra Power Company.

SAN FRANCISCO, CAL.—Bids will be received up to August 9th for machinery to be installed at a temporary power plant on the banks of the Tuolumne River to furnish power for construction work on the Hetch-Hetchy water supply project.

FALL RIVER MILLS, CAL.—The California Power & Manufacturing Company's electric system is in full operation. Electricity is now operating seven pumps and the flour mill.

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ELECTRICAL PRICE INDEX

Attachment Plugs

Type No.	Cost per 100	List per 100	Sell per 100
Solid		\$.25	\$.25
Separable .....		.30	.30
Separable, brass cap. ....		.40	.40
2 Light.....		1.00	1.00
3 Light.....		1.50	1.50

Annunciators

Medium Grade House Annunciator			
2 number.....			3.00
4 number.....			4.00
6 number.....			5.00
8 number.....			6.00
10 number.....			7.00
12 number.....			8.00
16 number.....			10.80
20 number.....			13.60
25 number.....			17.10

Automatic Set Back

4 number.....			6.40
6 number.....			7.90
8 number.....			9.40
10 number.....			10.90
12 number.....			13.15
16 number.....			16.80
20 number.....			20.50
24 number.....			25.00

Elevator Annunciator

4 number, single row.....			6.75
5 number, single row.....			7.50
6 number, single row.....			8.25
7 number, single row.....			9.00
8 number, single row.....			9.75
9 number, single row.....			10.50
10 number, double row.....			12.00
12 number, double row.....			13.50
14 number, double row.....			15.00
16 number, double row.....			18.00
18 number, double row.....			20.25
20 number, double row.....			21.75

The correctness of these suggested selling prices is not guaranteed by the publisher.

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ELECTRICAL PRICE INDEX

Boxes—Outlet, Galvanized.

Type No.	Cost per 100	List per 100	Sell per 100
3-B. Round outlet and junction box, 4" diam., 1 5/8" deep, 4 outlets in sides and 5 in bottom, for 1/2" or 3/4" conduit		25.00	25.00
8-B. Deep, round outlet and junction box, 4" diam., 1 5/8" deep, 4 outlets in sides and 5 in bottom, for 1/2" or 3/4" conduit		25.00	25.00
8-B. Deep, round outlet and junction box, 4" diam., 2 1/4" deep, 4 outlets in sides and 5 in bottom, for 1/2", 3/4" or 1" conduit, 4 outlets in sides only for 1" conduit		32.00	32.00
600 Round outlet box for combination gas and electric fixtures, 4" diam., 1 5/8" deep, 4 outlets in sides and 4 in bottom for 1/2" conduit. For 3/4" conduit, 4 outlets in sides only.....		45.00	45.00
600-A. Round outlet box for combination gas and electric fixtures, 4" diam., 2 1/4" deep, 4 outlets in sides and 4 in bottom, for 1/2" conduit. For 3/4" conduit, 4 outlets in sides only.....		57.00	57.00
8-N. Round receptacle box, 4" diam., 1 5/8" deep, 4 outlets in sides only, for 1/2" or 3/4" conduit.....		25.00	25.00
31 Open cover with ears.....		14.00	14.00
31 Open canopy cover.....		14.00	14.00
40 Closed cover		14.00	14.00
62-S Cover flush steel for Federal socket		14.00	14.00
62 Cover flush brass for socket.....		62.00	62.00
63 Cover lapped brass for socket.....		65.00	65.00
76 Flat steel cover.....		12.00	12.00
83 Cover for P. & S. receptacles 61777 and 61977		14.00	14.00
17-A. Round receptacle and outlet box, 3 1/4" diam., 1 5/8" deep, 4 outlets in sides and 1 in bottom, for 1/2" conduit only		20.00	20.00

The correctness of these suggested selling prices is not guaranteed by the publisher.

Fold Here

Journal of Electricity, Power and Gas ELECTRICAL PRICE INDEX

Bells and Buzzers

Number
2

Iron Box

Cost List Sell

2 1/2 in.....	.....	.....	.60
3 in.....	.....	.....	.60
4 in.....	.....	.....	.75
Fancy Gong .....	.....	.....	1.00
Bell Ringing Transformers, light work. ....	.....	.....	5.00
Bell Ringing Transformers, heavy work. ....	.....	.....	12.00

Lungen Buzzers—Watch Case Buzzers

Lungen Buzzers No. 0.....	.....	.....	.90
Lungen Buzzers No. 1.....	.....	.....	.65
Lungen Buzzers No. 2.....	.....	.....	.80
Lungen Buzzers No. 3.....	.....	.....	.85
Lungen Buzzers No. 4.....	.....	.....	.90
Brass Box .....	.....	.....	.60

Single Stroke Bell

Gong Ohms

2 1/2.....	5.....	.....	3.25	2.65
3.....	5.....	.....	3.00	3.00
4.....	6.....	.....	3.75	3.50
5.....	6.....	.....	5.50	4.60
6.....	6.....	.....	6.00	5.00
7.....	6.....	.....	7.50	6.75
8.....	8.....	.....	10.00	8.50
10.....	8.....	.....	11.75	10.00
12.....	8.....	.....	14.50	12.00

Skeleton Bells—Class B

2 1/2 in.....	.....	.....	2.30
3 in.....	.....	.....	2.35
4 in.....	.....	.....	2.50
5 in.....	.....	.....	4.50
6 in.....	.....	.....	4.75
7 in.....	.....	.....	7.75
8 in.....	.....	.....	8.60

Weatherproof Single Stroke

Gong Ohms

2 1/2.....	5.....	.....	5.25	4.50
3.....	5.....	.....	5.35	4.55
4.....	6.....	6.00	5.00
5.....	6.....	8.00	6.50
6.....	6.....	8.50	7.00
7.....	6.....	10.00	8.50
8.....	8.....	13.10	11.00
10.....	8.....	15.50	12.50
12.....	8.....	18.90	15.00

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Journal of Electricity, Power and Gas ELECTRICAL PRICE INDEX

Number
3

10 in.....	14.00
12 in.....	.....	.....	15.50
14 in.....	.....	.....	40.00
15 in.....	.....	.....	52.00

Batteries

Bell Battery .....	.....	.....	.35
Ignition Battery .....	.....	.....	.35
Ignition Battery, large size.....	.....	.....	.85
Samson Battery, complete.....	.....	.....	2.50
Samson Battery, carbon.....	.....	.....	1.45
Samson Battery, zincs.....	.....	.....	.90
Samson Battery, cover.....	.....	.....	.15
Sal ammoniac, pkg.....	.....	.....	.20

Push Buttons

Round Stamped Metal.....	.....	.....	.25
Elongated Stamped Metal.....	.....	.....	.50
Cast Bronze, with speaking tube M. P. ....	.....	.....	1.50
Cast Bronze, elongated, 1 push.....	.....	.....	1.00
Cast Bronze, elongated, 2 push.....	.....	.....	1.50
Cast Bronze, with card holder.....	.....	.....	.85
Cast Bronze, round screw top 2 3/8 in.....	.....	.....	.70
Cast Bronze, round screw top 1 1/2 in.....	.....	.....	.60
Cast Bronze, watertight, 2 3/8 in.....	.....	.....	2.40

Wood

Round, 1 1/2 in. dia.....	.....	.....	.15
Round, 1 3/4 in. dia.....	.....	.....	.20

Miscellaneous

Table Clamp .....	.....	.....	.75
Combination Foot Push.....	.....	.....	.75
Plain Foot Push.....	.....	.....	.50
Flat Top Push (table or floor).....	.....	.....	1.00
Mite Push .....	.....	.....	.30
Midget Push, single contact.....	.....	.....	.35
Midget Push, double contact.....	.....	.....	.45
Pear Push, wood, plain.....	.....	.....	.20
Pear Push, wood, fancy.....	.....	.....	.25
Wood Base Switch, 1 point.....	.....	.....	.15
Wood Base Switch, 2 point.....	.....	.....	.20
Dandy Floor Push.....	.....	.....	1.50
Toggle Bolts .....	.....	.....	.05

The correctness of these suggested selling prices is not guaranteed by the publisher.

The company has 14 miles of transmission line and is developing 250 horsepower.

SPOKANE, WASH.—An inland lake six miles long and half a mile wide will be formed near Three Island Park, if plans now being made by the Spokane Valley Power Company are carried out. A franchise for the power company is before the city council.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has commenced the construction of a new hydroelectric power plant to be located on the Bear River, in Idaho, at Cove, about one and one-half miles below the company's present Grace plant. A force of 350 men are already on the ground and at work on the foundation, flume and dam. This number will be increased, it is said, in the near future to 450, and work on the power house, dam and flume will be pushed vigorously during the summer and fall months, and it is expected the station will be completed in May, 1917. The new plant will be the fourth owned by this company deriving its power from the Bear River. The company's hydroelectric system on this waterway begins at the Bear Lake, which is used as a natural storage reservoir. A canal carries the water of the lake back into the river at those seasons of the year when the water is low. In order to augment the work of the outlet canal, the power company is now constructing an electrically operated pumping station between Mud Lake and Bear Lake. Five electrically driven pumping units having a capacity of 1500 sec. ft. will be installed at this plant, which is known as Lifton. About 200 men are now engaged in making this installation, and the plans call for completion of this work early this fall. It is said that the pumps at Lifton are the largest of their kind ever manufactured.

TRANSPORTATION.

NAMPA, IDAHO.—An ordinance has been passed by the council granting to the Boise Valley Traction Company an Electric Railway franchise on Third and other streets.

NATIONAL CITY, CAL.—Work on the \$70,000 extension of the electric railway to Chula Vista by way of Potash and Marmarosa has been resumed by order of the Spreckels companies, following the settlement of the local jitney bus controversy.

POMONA, CAL.—Freight depots will be built soon at Pomona and Claremont by the Pacific Electric Company. It is also announced that the company contemplates building a line from Pomona to the Chino district and a spur line into the foothills near this city.

VISALIA, CAL.—It is generally reported in Visalia that the Southern Pacific Company will electrify its line from Visalia to Porterville in the near future, making a loop for the electric line. The extension will tap some of the most highly developed citrus land of Tulare county.

PHOENIX, ARIZ.—The Carlisle Mining Company will erect an electric generating plant at Duncan or some nearby point on Frisco River. The plant will furnish power for mining operations, and will also probably supply current for an electric road from Duncan to the mine, 13 miles distant.

PASADENA, CAL.—The board of trade here will endeavor to prevent the Pacific Electric Company from putting in the interlocking dispatch system at this time and require it to proceed with plans for the million dollar viaduct eliminating grade crossings. The company already has the plans and figures for this improvement.

FRESNO, CAL.—The Fresno Interurban Railway Company has completed its line as far as the Academy road above Sanger and it is announced that the company has no plans at present for future extensions. The completion of the line to the Academy gives the company 17 miles of tracks in this county.

LINDSAY, CAL.—Actual construction work on the Visalia Electric branch from Exeter to Lindsay, thence to the El Mirador orange district, with its present terminus in the town of Strathmore will commence in about two weeks. The company is now establishing an office on Honolulu street, in this city. The right-of-way has practically all been secured and definitely decided upon, with the exception of the spur into Lindsay.

SAN FRANCISCO, CAL.—The Church street line of the Municipal Railways is complete. The road is ready for operation from Market street along Church street to Twenty-ninth street, but it lacks cars and electric power. Plans were made to connect the road with the municipal line of Van Ness avenue by tracks on Market street, but the city has so far been stopped from constructing the connecting line by injunction proceedings brought by the United Railroads.

TELEPHONE AND TELEGRAPH.

LONG BEACH, CAL.—Announcement has been made that the Pacific Telephone & Telegraph Company will rebuild and extend its lines here at a cost of \$23,900.

FILLMORE, CAL.—The Pacific Telephone & Telegraph Company is preparing to install new office equipment here costing \$4100, and to make outside improvements to its system costing \$1900.

VACAVILLE, CAL.—The St. John's Mine Company of Vallejo has been granted permission to erect a telephone line along the county road from Vallejo Sulphur Springs to the city limits of Vallejo.

GLOBE, ARIZ.—The Mountain States Telephone Company will start construction immediately on a system here to cost about \$50,000. All material and equipment for the work is on the ground.

MT. VERNON, WASH.—Announcement has been made that the Puget Sound Telephone Company will build a two story brick building on the Gates street site to be ready for occupancy by next June.

SANTA FE, N. M.—The Postal Telegraph Company is preparing to rebuild its line from Raton to Albuquerque. Supplies have already been received in Las Vegas.

DOUGLAS, ARIZ.—It has been decided to abandon the present toll line of the Mountain States Telephone & Telegraph Company as soon as a new line can be constructed. Work of surveying for the new line has been started.

DEMING, N. M.—A new toll line is to be constructed by the Mountain States Telephone Company from El Paso to Lordsburg, which will also be extended to Benson, Arizona. The project represents an outlay of \$181,000 and is 160 miles in length.

SANTA BARBARA, CAL.—It is considered probable that the merger of the Home and Pacific Telephone Companies here will result in the rebuilding of some of the long distance lines in the county. The merger of the companies is still some months off, however.

CORONADO, CAL.—A new telephone exchange will be built here, the Pacific Telephone Company having signed a lease covering the erection of a concrete building at the corner of Eighth and Orange avenue. The cost of the office equipment is estimated at \$25,000.

WINNEMUCCA, NEV.—Hugh L. Thomas, manager of the Utah, Nevada & Idaho Telephone Company, is starting work on the Kennedy extension of the company's line. This line is to be extended from Goldbank's quicksilver mine to the mining camp at the south end of Pleasant Valley.

SAN DIEGO, CAL.—An expenditure of \$6000 in the Hillcrest District and in Ocean Beach is being made by the Pacific Telephone Company. In addition to this, \$16,000 has been appropriated for additional toll equipment for a composite duplex toll cable from the main office, Los Angeles, to Seventh and Anderson streets, and to Eighth and Central

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page preceeding

- | | |
|--|---|
| A-1 American Ever-Ready Works of National Carbon Co..
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland.
Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco;
Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson. |
| A-2 Atchison, Topeka & Santa Fe Railway Co.....
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| B-1 Baker-Joslyn Company..... 5
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| 3-2 Benjamin Electric Manufacturing Co.....
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| C-1 Century Electric Co..... 2
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(All Jobbers.) |
| C-3 Crocker-Wheeler Co.....
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles. | N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co..... 4
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| D-4 Davis Slate & Manufacturing Co..... 3
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| D-2 Dearborn Drug and Chemical Works..... 11
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| F-1 Fairbanks, Morse & Co.....
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428 Market St., San Francisco. | W-2 Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 900 First Ave., Seattle; 45 North Fifth St., Portland, Ore. |
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| H-7 Hurley Machine Co.....
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| I-2 Illinois Electric Co.....
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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXVII No. 6

SAN FRANCISCO, AUGUST 5, 1916

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THE PROPOSED SAN FRANCISCO-OAKLAND
BRIDGE.
COMPUTATION OF SKIN EFFECT FOR STRANDED
CABLES.

BY CLEM COPELAND.

CONSTRUCTION OF IRRIGATION CHECKS.

BY S. T. HARDING.

PROSPECTIVE MARKET FOR IRRIGATION
PUMPING.

BY JOSEPH JACOBS.

ACTIVITIES OF SAN FRANCISCO ELECTRICAL
CONTRACTORS.

BY C. F. BUTTE.

MATERIALS ADVERTISED IN THIS ISSUE

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Electric Storage Battery Co.

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Dearborn Chemical Co.

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Morse Chain Co.

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Baker-Joslyn Co.

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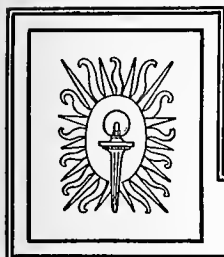
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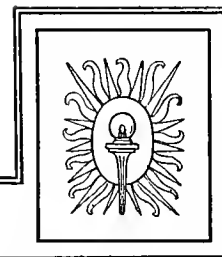
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Bird's Eye View of Proposed San Francisco-Oakland Bridge.

THE PROPOSED SAN FRANCISCO-OAKLAND BRIDGE

The records show that as far back as the days of Collis P. Huntington numerous schemes for interlinking Oakland and San Francisco either by tunnel or bridge have from time to time been put forth.

During recent years, however, the rapid growth of the bay cities—Oakland, Berkeley, Alameda and San Francisco—now totaling nearly a million in population make the problem one of vast economic importance. Five ferry systems now convey the traffic from the east bay cities back and forth to San Francisco. Indeed, a careful estimate shows that over 40,000,000 people cross annually between the bay cities. The number of people passing daily through the ferry building at the foot of Market street is exceeded by but one other terminal in the world, namely, the Union Station in Paris.

Physical Features of Proposed Bridge.

The bridge that is now put forth for the earnest consideration of the various civic bodies about San Francisco Bay is to be located so that the Oakland terminal will be at First and Adeline streets and the San Francisco terminal at Second and Townsend streets.

The proposed bridge has 80 spans in its length of five and a half miles and although the spans are not of excessive length, they are very heavy. The bridge will be one of the heaviest bridges ever built, for it will carry three roadways and four railroad tracks.

The bridge will be the greatest bridge structure ever built. The main portion of the bridge is made up of sixteen spans 250 ft. long and just alike. Near the San Francisco shore there will be two very high spans under which the shipping will pass. These spans will be 600 ft. long and will be by far the heaviest and longest spans of their kind ever built. There will also be two movable spans in the bridge which will be not only the heaviest movable spans ever built, but the only ones of their kind in the world.

The bridge will be a double deck structure with the three roadways on the upper deck and four railroad tracks on the lower deck. Its capacity has been made great enough to provide for the increase in traffic for many years to come. It will have two tracks for overland passenger trains, two tracks for electric trains, two separate roadways for slow moving vehicles, one in each direction, and one wide, specially designed, boulevard-like roadway for automobiles only. The bridge will be five and one-half miles long, and could be completed within four years.

Special attention has been given to the handling of the automobile traffic. The automobile boulevard being paved with the latest type of wood blocks, the approaches having low grades and wide sweeping curves.

The grades, the curves, and the block signals for the railroad tracks have all been planned so as to allow the high speed which modern traffic conditions require.

Proposed Bridge Site Compared with Other Possible Sites.

The proposed bridge is located on the shortest line between the centers of San Francisco and Oakland. This location for the bridge was not chosen primarily however because it is the shortest route between the business centers, but because the depth of the water in the bay at the point of crossing is very shallow, and because it placed the bridge beyond ninety-five per cent of the present shipping of the bay. The starting point of the bridge in Oakland is such that all of the existing electric lines and all of the steam railroads on the west side of the bay can be easily diverted to the bridge. After crossing the bridge the electric interurban trains will be run on an elevated structure to the heart of San Francisco's business center.

Before deciding upon this location for the bridge, however, all other points for crossing the bay were considered. At first thought it would seem as though the best point of crossing would be by way of Goat Island but that route is impossible from an engineering standpoint because of the great depth of water between Goat Island and San Francisco. Also a bridge at that point would be a serious obstruction to the entrance to the harbor, and it would be difficult, if not impossible, to obtain the government's consent to the use of Goat Island.

Discussion of a Possible Tunnel Project.

Among the many schemes which have been suggested for connecting the east bay cities with San Francisco has been a tunnel under the bay. A tunnel has never been seriously considered by engineers, however, because it is impracticable and too costly, but the idea of going under the bay instead of over it, at first thought, appeals to many people who do not understand the problems connected with such construction.

A tunnel which will provide adequate facilities for handling the traffic which crosses San Francisco Bay would have to have the same capacity as the bridge which is now being considered, that is, it would have to have at least three roadways and four railroad tracks. Such a tunnel or rather series of tunnels is entirely impracticable because of the great cost which would be several times the cost of a bridge.

Possibly the greatest objection to a tunnel, however, would be the liability of an accident from earthquake. The inhabitants of San Francisco would not relish the thought of being in a tunnel under a hundred feet of water when there was even a slight earthquake.

Also there would be great difficulty in ventilating such a deep and long tunnel as would be required. So it is not thought that even could a tunnel be constructed for the same cost as a bridge that it would be popular with the people.

Bridge Would Reduce Possibility of Accidents.

The United States Government's Bulletin on the Climate of San Francisco says, "One of the most marked climatic features of San Francisco is the prevalence of fog." To the citizens on land the fog is considered one of the city's assets and "San Franciscans

love their fog," but the fog is far from being an asset to the shipping interests.

In the summer these fogs move through the Golden Gate about 1 p. m. and in the winter they appear in the mornings. Frequently the fog is so dense on the water that one can see but a few feet through it. With the increase in shipping the difficulty of navigation on the bay in these dense fogs is becoming greater and greater.

The construction of a bridge which will allow the people to be carried quickly and safely across the bay on electric trains is desired not only by the traveling public but by the shipping interests as well, because it will free the bay of the numerous ferry boats of the five different ferry systems which now operate boats at right angles to the path of practically all ships which enter the harbor.

Advantages that Will Accrue from Bridge.

The advantages of a bridge to the bay cities is obvious. It is axiomatic that rapid transit between two business centers is beneficial to both. The amount of business transacted between the cities on the two sides of the bay is so great that their commercial development demands better transportation facilities, not only for passengers but for vehicles as well.

Aside from the greater ease, safety and comfort with which people will be able to go from one city to the other, the economic saving in time to the millions of people who cross the bay each year will amount to millions of dollars.

Estimated Costs.

The estimated cost of the proposed bridge is \$22,000,000. It is proposed that the bridge shall be owned and controlled jointly by the two counties adjoining the bay and that a toll shall be charged to the railroads and to vehicles for the privilege of crossing the bridge. It is estimated that these tolls will pay the interest on the cost of the bridge as well as the cost of maintaining it.

The Present Status.

The plans of the proposed bridge have been submitted to the Secretary of War by the Federal Government, for approval and a board of army engineers has been appointed to hold public hearings in San Francisco and Oakland on August 15 to 18 inclusive on the plans and to report on their feasibility. This board is composed of Col. Thos. H. Rees, engineer of rivers and harbors of San Francisco, Col. Chas. L. Potter, engineer of rivers and harbors of Portland, and Major George B. Pillsbury, engineer of rivers and harbors of Los Angeles.

The plans for a bridge over San Francisco Bay which are now being considered by the communities around the bay, were prepared by Wilbur J. Watson Co. of Cleveland, Ohio, William Russell Davis of Albany, New York, and Harlan D. Miller of Oakland.

Woodrow Wilson, in his excellent essay, "When a Man Comes to Himself," says: "It is the discovery of what they can not do, and ought not to attempt, that transforms reformers into statesmen and great should be the joy of the world over every reformer who comes to himself."

COMPUTATION OF SKIN EFFECT FOR STRANDED CABLES.

BY CLEM A. COPELAND.

(In the issue of July 29, the author discussed the phenomenon of alternating currents persisting in flowing along the outer "skin" of the cross-section of a conductor and forsaking the central area. Formulas for numerical computations were given and numerical illustrations set forth which enable the engineer to compute this so-called "skin effect" for any size of wire or rod of solid cylindrical form composed of any non-magnetic metal at any frequency, up to say 3,000,000 cycles at any temperature. Cables, however, are composed of stranded sections. Indeed, such a section is shown in this article to materially reduce the "skin effect" under certain conditions, and is consequently to be preferred in many instances. By a similar treatment as followed in the first article the author herein shows how to compute this effect for stranded cables and by concrete illustrations sets forth comparisons of the skin effect of copper and aluminum stranded cables and also computes the skin effect for underground cables. As an interesting side-light he further shows to what extent the so-called "spirality effect," or twisting of stranded cables, enters into computations for "skin effect."—The Editor.)

Mr. Kennelly and others have very conclusively proven that the skin effect ratio for concentrically laid stranded cables is the same as would occur in a solid wire or rod having a cross-section equal to the sum of the cross-sections of the wires composing the cable, whether these wires are twisted or laid spirally or are all kept parallel and straight so long as the cable is symmetrical, i.e., composed of 7, 19, 37, 61, etc., strands symmetrically disposed around a central strand or wire, all of the strands being of the same size. This statement is practically correct for all frequencies below 1200 cycles per second.

It has also been observed that the total self-induction ($K_L L_{dc} + L_e$) of a circuit of cable has from .981 to .987 of the self induction of a like circuit of an "equivalent" solid wire, up to 5000 cycles, or so.

These differences if any, between K_R and K_L for a cable and an "equivalent" solid wire are termed "spirality effects."

Kennelly states that the skin effect may be eliminated entirely by insulating the strands of a cable from each other and at the same time transposing them so that any one strand occupies, in succession, different positions in the cross section. A cable made up of six strands wound over a hemp core, each strand being composed of three insulated wires would therefore entirely eliminate skin effect.

The "spirality effect" at high frequencies is shown by Mr. Kennelly's curves of Fig. 4 which are plotted from Table VI giving the results of tests on 7-strand copper and aluminum cables having total cross-sections of 211,600 and 211,950 cir mils respectively.

TABLE VI.

Skin Effect in No. 0000 7-Strand Copper Cable.

A ₁₂ Inches.	Frequency f Cycles.	Temperature, C°	Observed, K _R
24.47	60	12.0	1.005
	207	25.7	1.035
	475	27.0	1.233
	925	26.8	1.582
	1468	27.0	1.966
	2010	27.0	2.295
	3065	27.7	2.802
	3920	27.5	3.151
	5040	27.2	3.552
2.92	60	20.0	1.004
	189	12.4	1.063
	682	12.3	1.458
	1090	15.8	1.789
	1540	16.2	2.117
	2010	17.2	2.470
	3112	18.9	3.103
	3960	17.8	3.615
	5040	14.4	4.130

Problem II—Conditions:

Conductor, solid hard drawn aluminum of average purity.

Size: 750,000 cir mils.

diam. = .8660254 in.

$r_1 = .8660254''/2 = .4330127''$.

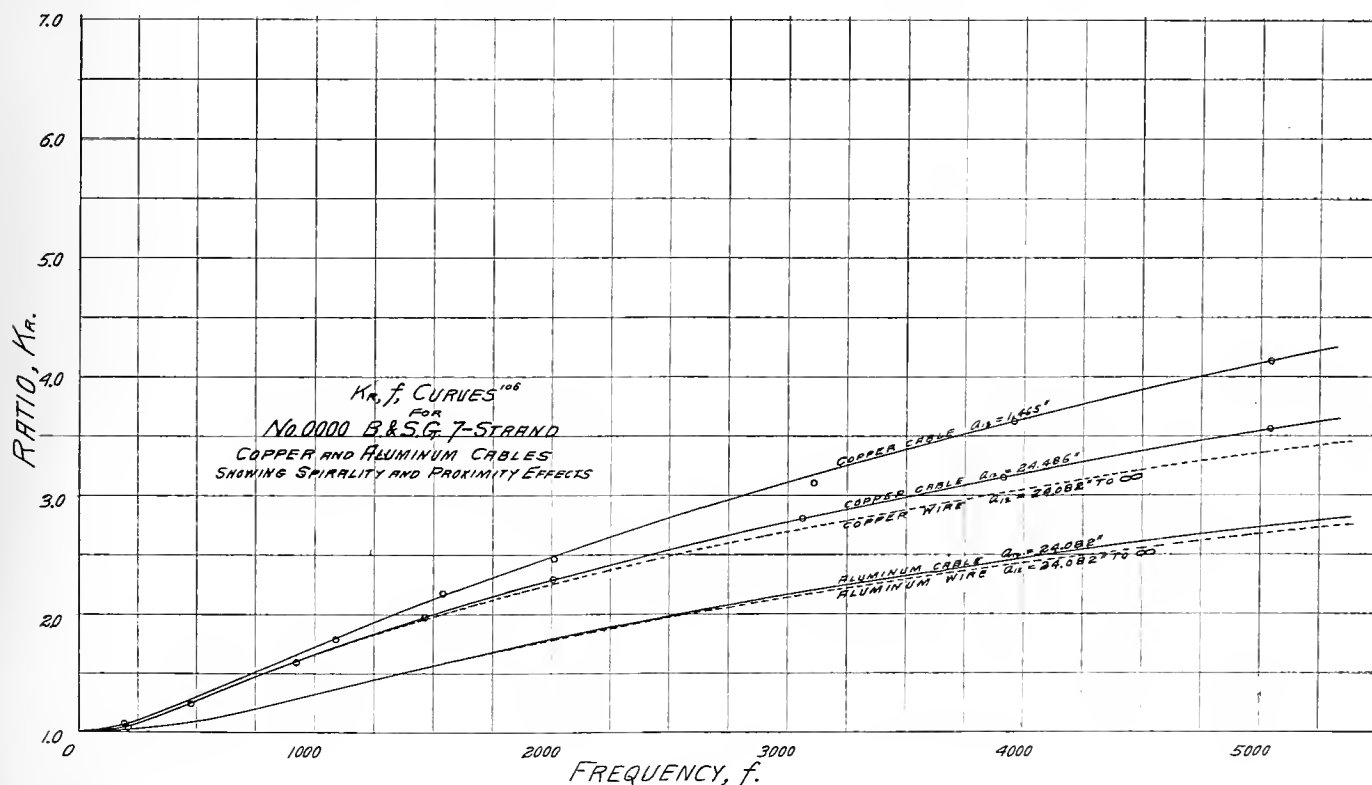


Fig. 4.

$A_{12} = 120$ in.; and therefore an absence of "proximity effect."

$$f = 60 \text{ cycles.}$$

$$\text{Temperature } 20^\circ \text{ C.} = 68^\circ \text{ F.}$$

$$10^9 \rho = 2828.$$

$$\kappa = 22.570 \times .4330127 \sqrt{60/2828} = 1.423633.$$

$$K_R = 1.02105.$$

$$K_L = .98951.$$

Found by interpolation by means of curves.

Problem III—Assume a summer temperature of wire with 144.2 amperes as $150^\circ \text{ F.} = 65.5^\circ \text{ C.}$

Assume temperature coefficient of .0039 per deg. at 20° C. to hold from 20° to 65.5° .

$$10^9 \rho = 2828 (1 + .0039 [65.5 - 20])$$

$$= 2828 (1.17745).$$

$$= 3329.828.$$

$$\kappa = 22.570 \times .4330127 \sqrt{(60/3329.828)}$$

$$= 1.31189.$$

$$K_R = 1.01523.$$

$$K_L = .99241.$$

Problem IV—We may find the size of a copper conductor for the same resistance by the "cut and try" method, thus:

$$10^9 \rho \text{ for aluminum at } 20^\circ = 2828 \times 1.02105.$$

$$= 2887.531.$$

Assume as a first trial that, for hard drawn copper, at 20° C.

$$10^9 \rho = 1724.1 \times 1.015 \times 1/.973.$$

$$= 1798.5,$$

the resistance of soft copper being .973 \times that for hard drawn copper.

$$A_{om} = \text{Area} = 750000 \times 1798.5/2887.5.$$

$$= 467142.8 \text{ cir mils.}$$

$$r_1 = .3417392.$$

$$\kappa = 22.570 \times .34174 \sqrt{60/1798.5} = 1.4088.$$

$$K_R = 1.0202.$$

Assume a new trial value of $K_R = 1.0202$.

$$10^9 \rho = 1724.1 \times 1.0202 \times 1/.973 = 1807.736.$$

$$\text{New } A_{om} = 750000 \times 1807.736/2887.531.$$

$$= 469536.9 \text{ cir mils.}$$

$$r_1 = .342613.$$

$$\kappa = 22.570 \times .342613 \sqrt{(60/1807.913)} = 1.408774.$$

$$K_R = 1.0202.$$

Thus no further trial is necessary and a 469536.9 cir mil hard drawn copper wire is equivalent to a 750000 cir mil aluminum wire at 20° C. and 60 cycles.

It is observed that this ratio would be slightly changed at the maximum temperature of 65.5° C. or 150° F.

The consideration of a cable having the same circular mils in either aluminum or copper in connection with the curves of Fig. 4, shows that no perceptible change would be made in the above figures. This statement has been further conclusively substantiated by other experiments, and the so-called "spirality effect" on the "skin effect" may be considered absent.

This calculation may therefore be accepted as correct for the 19 strand 750000 cir mil aluminum cable in the transmission line field laboratory of Stan-

ford University. This cable has an overall maximum diameter of .999", being 1.154 larger than a solid wire of the same cross section. The largest long distance conductor at present is that of the Niagara, Lockport and Ontario Power Company on their 60000 volt line in which a 19 strand 642000 cir.mil aluminum cable is used at 25 cycles.

Problem V—Illustrating the use of Mr. Kennelley's curves of Fig. 4.

Let a 2-conductor "duplex cable" be constructed for underground distribution at 750 volts and 60 cycles, each conductor consisting of $3\frac{7}{8}$ strands of soft drawn copper having dimensions equivalent to

$$A_{om} = 469536.9 \text{ cir mils.}$$

$$r_{1,2} = .342613 \text{ inches.}$$

Thickness of varnished cambric or "var-cloth" insulation, $3/32$ in.

Overall diameter of each conductor = .8104 in., being 1.182 larger than a solid wire of the same cross section. This cable will be laid with a jute filler and covered with a braided weatherproof insulation tape, etc., and not encased in a lead sheath.

For correspondence with Problem II we will assume a rather impure soft copper of $10^9 \rho = 1807.913$. We have further,

$$A_{12} = .1875 + .8104 = .9979 \text{ of an inch.}$$

It is desired to find K_R .

Take Kennelley's experiments Table I, on No. 0000 wire, and use his value of $K_R = 1.0038$ for $A_{12} = 24.082$ as the value of K_R for $A_{12} = \infty$, as in Formula (1) because it is evident that, by comparing this value with that at $A_{12} = 8.334$, the fourth decimal place would not have been changed by further separation.

Construct the following table:

	Ratio			
A_{12}	$r_{1,2}/A_{12}$	$K_{RA_{12}}$	K_{RP}	
∞	.00000	1.0038	1.0000	$r_{1,2} = .230$
24.082	.00955	0.9938	1.0000	
8.334	.02760	1.0058	1.0020	
2.9795	.07722	1.0087	1.0049	
.7448	.2970	1.0124	1.0086	
.46009	.5000	.....	.....	to 1 inch
$K_{RP} = \text{Ratio}$		$K_{RA_{12}}/K_R \infty = K_{RA_{12}}/1.0038.$		

From this table construct a curve of $X = r_{1,2}/A_{12}$, $Y = K_{RP}$.

From this curve one finds for a ratio

$$r_{1,2}/A_{12} = .342613/.9979 = .3433.$$

that $K_{RP} = 1.00919$.

$$\text{Finally } K_R = K_{RP} \times 1.0202.$$

$$= 1.00919 \times 1.0202.$$

$$= 1.0296.$$

The smallest interaxial distance which could occur with these cables would be about

$$A_{12} = .8104 \text{ in which } r_{1,2}/A_{12}.$$

$$= .3426/.8104 = .4225 \text{ at which,}$$

$$K_{RP} = 1.0195.$$

$$K_R = 1.0195 \times 1.0202.$$

$$= 1.041.$$

The resistance would thus be increased 4% above the value it would have with direct currents.

This process is considered correct and probably sufficiently accurate for ordinary practical work.

(Erratum:—Table II, Page 79, of issue of July 29, refers to $10^9 \rho$ and not ρ as there stated.)

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

CONSTRUCTION OF IRRIGATION CHECKS.

Where a road grader is used the blade should be at least seven feet long. This can be run lengthwise of the strips, throwing a light cutting toward the sides from the middle to form the levees. For narrow checks and small levees, this method gives better results than

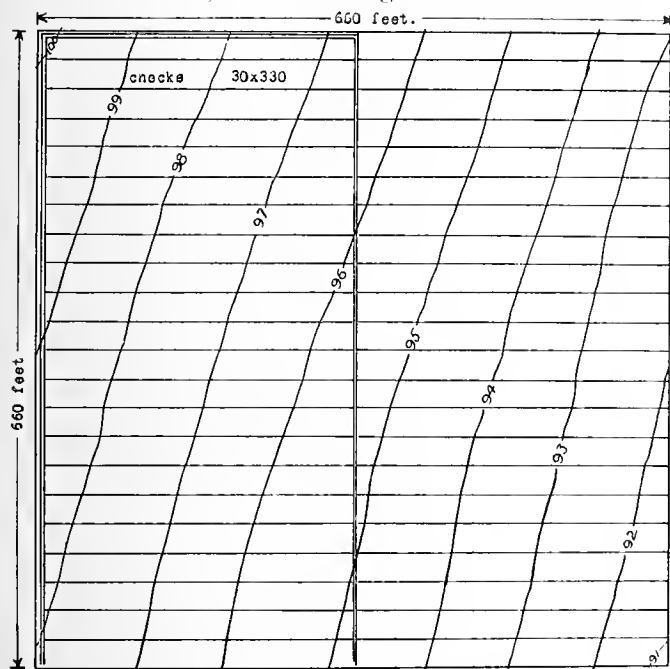


Fig. 1. Strip Checks for Ten Acre Field, Medium Light Soil, 400 Gallons per Minute Supply.

running across the checks with a Fresno and dumping on the line of the levees.

In order to grade land to advantage, the soil should be in a similar moisture condition to that needed for general plowing. Heavy soils, when dry, may break into large clods which are difficult to reduce. Such lands can best be handled in the spring or after the first fall rains, if later rains do not interfere.

How the Checks are Made.

Where small irrigating heads are used, large levees are not required. The more carefully the checks are prepared, the less will be the need of high levees, as the water will not back up on any part of the check. The present tendency is toward small, well rounded levees, which while retaining the water in the checks, do not interfere with farm operations. For heads of 1 or 2 second feet, levees which settle to a height of 6 inches are sufficient. To allow for settlement and compacting by farm machinery, such levees should be built with about 2 in. excess height. The width of the levee should be 5 or 6 ft. for these heights. After the earth for the levees has been placed, a smoother is run over them, one form of such smoother being shown in the illustration.

In levelling land, it should first be plowed. If uneven, so that much grading is required, only the knolls may be plowed at first. The heavier grading can be done before the checks are marked out. A light furrow may be run along the levee lines to mark

them. The earth for the levees is then secured and the final grading and smoothing within each check completed. Before seeding, water should be run in each check to settle fills and enable the final smoothing to be made. Where much grading has been done, more than one trial irrigation may be needed. If it is necessary to irrigate the new seeding before it has become sufficiently strong to prevent washing, much care may be needed to prevent eroding the checks. This is particularly true on the steeper slopes.

The Cost Involved in Preparation of Land.

The cost of preparing land in checks varies widely. Contract costs usually include the field ditches and sometimes the structures. For very uniformly sloping smooth land, the cost of preparation may be mainly the cost of constructing the levees. Including plowing, levelling and trial irrigation, the cost under the most favorable conditions will be \$3 or \$4 per acre. This does not include any cost for removing native vegetation. In California the lands now being prepared for irrigation under pumping plants have nearly all been in use for grain farming, so that such clearing is not required.

For uneven land, the cost of levelling may be as high as \$50 or more per acre. Such costs might be required on hog wallow lands or lands of uneven or irregular slope. For such land, the cost is necessarily high. Careful arrangement and planning of the checks may reduce it, however.

For usual conditions, the cost of levelling, exclusive of the structures, will be from \$8 to \$15 per acre. Many fields will cost as high as \$25 per acre.

Strip Checks.

Strip, border, ribbon, or gravity checks, as they are variously called, are largely used in California practice. These consist of parallel checks, having a length of from 6 to 15 times their width. They are given a slope in the direction of their length, but are level transversely. The selection of the length and width for any given case depends on the soil, slope and crop. While all soils can be irrigated by this method, it is best suited to those which absorb water readily. For heavy soils, level checks which give areas on which the water can be ponded until absorbed give better results with less waste. By properly adjusting the size of check to the size of irrigation head, level checks can also be used on very porous soils.

Proper Heads of Water for Check Irrigation.

For irrigating heads of 2 second feet or less, the size of border checks is smaller than for general gravity supply practice. The levees can also be made of less height. For small heads, widths of greater than 50 ft. are not desirable. The best results on average soils and large heads are secured with widths adjusted, so that the flow will be equivalent to 0.08 or more second feet per foot of width. This ratio can hardly be maintained for the small irrigating heads, due to practical considerations, although it would give an efficient use of water. By using larger slopes than are practical with large heads, good practice for small heads

would be represented by the use of heads of from .03 to .05 second foot per foot of width of strip check, on rather pervious soils. This is equivalent to a flow of about 12 to 20 gallons per minute per foot width of check. For heads of 1 second foot for such pervious soils, this would give a width of 20 to 33 ft. For heads of 2 second feet, widths of 30 to 40 ft. represent good practice. On soils of medium texture, such as silt loams, somewhat greater widths might be used; on heavy soils where small heads must be allowed to run for relatively long times, in order to secure sufficient absorption, narrow widths are desirable, as it is difficult to level wide checks with sufficient care transversely to secure even distribution with such small flows.

Relative Proportions for Checks.

The length of strip check should be adjusted to the soil and head. If the irrigating heads do not exceed 1 second foot, the length should not exceed 330

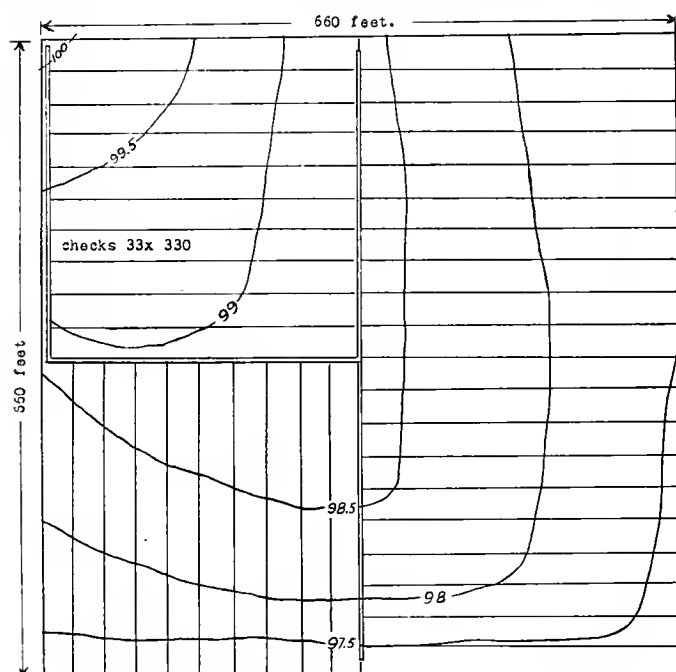


Fig. 2a. Ten Acre Field Laid Out in Strip Checks to Fit the Slope.

ft., and less would be preferable for the lighter soils. On heavy soils, lengths up to 660 ft. are sometimes used. A reduction in the width of checks increases the number of dikes or levees in the field, and the number of turnouts from the ditches, but does not increase the number of ditches. A reduction in length of checks does increase the number of field ditches with resulting inconvenience in handling the crop. For this reason, the length of checks is often made greater than it otherwise would be. For long checks, the amount of water which must be turned into the check to cover the lower one-third of the check may be as great as that needed for the upper two-thirds. The difficulty of covering long checks is becoming better realized, and the tendency is toward the use of smaller lengths. Checks 33x330 contain one-fourth of an acre; those 40x400, three-eighths of an acre. For small heads, strip checks of over one-half acre should not be used.

The slope of strip checks does not need to be uniform, and it is not usual to make it so if the slope of the land is irregular. For large heads, slopes of 2 to 4 in. with maximums of 12 in. per 100 ft. are representative of good practice. With small irrigation heads, greater slopes can be used and are desirable. After a stand has been secured, small heads can be run on slopes of 2 ft. per 100 ft. without washing, although some difficulty in irrigating the new seeding may be experienced. Steeper slopes are the most desirable on the lighter soils, however. As these are the most liable to wash, greater care must be used in handling the water.

Rectangular Checks.

On lands having no general slope in any direction, level checks can often be used to advantage. Under similar soil conditions, level checks may have areas similar to those for strip checks, the shape, however, being different. Level checks may be square; a check

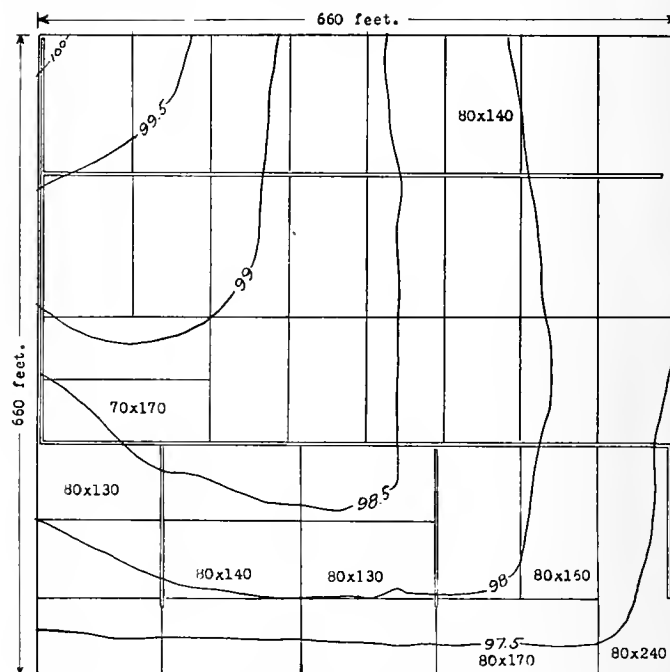


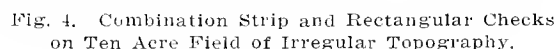
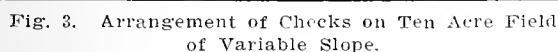
Fig. 2b. Ten Acre Field as in Preceding Figure, but Laid Out in Rectangular Checks.

200x200 ft., containing nearly an acre should not be exceeded in size even on heavy soils, unless heads of over 2 second feet are available. A check 100 ft. square contains nearly one-quarter acre. It is generally preferable to make such checks with the length about twice the width. This enables the dimension in the direction of the slope of the land to be reduced, thus reducing the amount of grading to be done. It also reduces the number of field ditches. On light soils the area of the checks should not exceed one-eighth of an acre per second foot of supply. For one second foot heads, this would give checks about 50x110, and for 2 second foot heads, checks about 75x150. On very porous soils, smaller checks than these are preferable. If the land has much slope, longer and more narrow checks may be used. While on heavy soils the rate of absorption may be sufficiently slow so that larger checks could be filled with small heads, large checks are not usually desirable. The amount of grading re-

The methods of grading for level checks are similar to those for strip checks. Earth from the high side of one check can be placed on the low side of the check above with less haul than to carry it to the low side of its own check. Where much cutting is to be made on wide checks, this is advisable; for narrow checks, levelling within each check is more usual. While such checks are practically level, it is preferable to give a slight fall away from the turnout box. This fall should be one or two inches for small checks, being

Contour Checks.

Contour checks are essentially the same as the level checks previously discussed, except that they are irregular in shape instead of rectangular. Where the contours are straight and parallel, contour checks become rectangular checks. The use of contour checks was formerly more general than at present and few, particularly for small checks, are now built. The contour check has the advantage of being fitted more closely to the original ground surface and of requiring less grading; for small checks this difference is not material. They have the disadvantage of being irregular in shape, requiring irregular ditch locations and adding to the inconvenience in handling the crop. In rough fields, a few contour checks may be used in certain portions to reduce the cost of preparation; they are not now considered desirable for fields as a whole.



Level checks may be preferable for either very heavy or very light soils. On heavy soils it may be necessary to pond the water on the land, in order to get a sufficient depth of absorption. This can be done most easily and uniformly with level checks. On very light soils, washing may occur on sloping checks. This is not to be expected, however, with irrigating heads, as small as those under discussion here. The chief use of level checks, except in very heavy soils, is for those conditions where long, narrow, sloping checks cannot be arranged without excessive grading. It may

Examples of Check Design.

In Fig. 1, a field having a uniform slope in two directions is shown. For the light soil and small head shown, the checks are run down the steeper slope, about 1 in 100. For checks running down the flatter slope, about 4 in. per 100 ft. could be used and would

be preferable for heavier soils or for larger heads. For larger heads, the checks could be made wider, such as 40 ft., if a supply of $1\frac{1}{2}$ or 2 second feet were available. For heavier soils, the checks might be 660 ft. long, thus avoiding the ditch through the center of the field.

In Figs. 2a and 2b, the same field is laid out for strip and level checks. Although the direction of the slope changes, the field can be adapted to strip checks, as shown in Fig. 2a. The rectangular checks in Fig. 2b are planned to give as little levelling as practical. For the 10 acres in this field, the strip checks shown require 1320 ft. of field ditch; the rectangular checks, 2260 ft. The field would be cut in three pieces if in

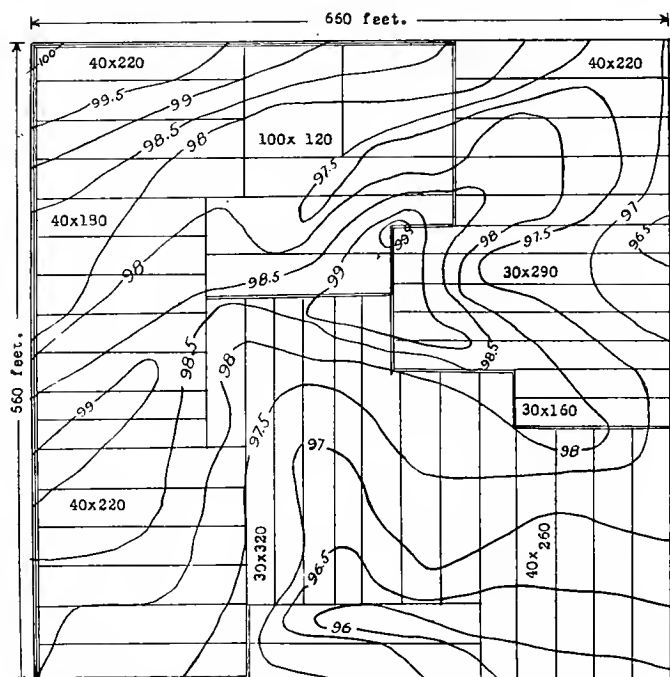


Fig. 5. Arrangement of Checks on Ten Acre Field of Uneven Surface.

strip checks; in five, if in level checks. If surface pipes are used instead of open ditches, this objection can be overcome. About 12,000 ft. of levees are required for the strips as compared with 5000 for the level checks. These comparisons show the advantages of the strip checks for land of this character. The strip checks usually have a slope of about 4 in. per 100 ft., and are made 33 ft. wide. A few checks have as small a slope as $1\frac{1}{2}$ in. per 100 ft. This could be increased by grading. The checks indicated would be suited to heads of 2 second feet on medium or light soils, or to 1 second foot on heavy soils. For heavy soils, the checks might be run across the whole field where the slope permits, as on the upper half.

In Fig. 2b, the checks have an area of about 0.3 acre. The amount of levee is smaller than for the strip checks, but the grading necessary to level the checks would be greater. The slope of the land is not large, and this field would be relatively inexpensive to prepare by either method.

Figs. 3 and 4 illustrate fields having slopes irregular in both amount and direction. These are planned for strip checks where feasible with rectangular level checks in the more irregular portions. For such fields, a number of arrangements are usually possible. If the

slope were smaller, such as half of those shown, rectangular checks for the whole field might be preferable. In Fig. 3 the strips are made 40 ft. wide in the flatter portions; a head of 2 second feet would be desirable for these. In the steeper portions this might be decreased to 30 ft., and 2 checks run at the same time. The length of the checks is limited by the topography. If only one second foot could be secured, the flatter checks should be made 20 to 34 ft. wide.

In Fig. 5 an arrangement of checks for a very uneven piece of land is shown. For such land, a topographic survey is practically necessary, if the checks are to be planned to advantage. The checks shown are planned to give the minimum amount of grading. Some additional levelling would avoid some of the irregularities, and would be desirable, such as to carry the main checks through to the lower end in the center and avoid the two checks shown. The knoll would require to be levelled to elevation 99 or lower, the earth going into the low strip above it. The supply ditch would have to be held in a light fill to reach it. The use of surface pipe to supply the checks would be of advantage if the water is secured by pumping.

On these sketches open ditches are shown. Surface pipe connected in the field for each irrigation could be used. The mowing and handling of the crop is much easier with such pipe. For permanent development concrete pipe with hydrants for each check could be used.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.

(Concluded.)

In reviewing the tabulation in Fig. 40 one will no doubt be struck by the apparent high annual cost of maintenance and operation, which is of course an important element of any irrigation project. These costs are in fact somewhat high, due to the high pump-age lifts involved but also it may be said that they appear high because we are as yet not accustomed to them in this northwest territory although they are not uncommon to other localities as for instance in California, in Porto Rico and in Hawaii, where no more valuable crops are grown than is possible to the lands herein considered.

I regard all the projects listed in the tabulation as ultimately feasible upon the lines outlined in the foregoing pages of this report, but before closing I would again advert to the fact that many cheaper gravity projects must precede them in order of development and that the larger projects will depend for their success upon some generous scheme of finance and credit founded upon co-operative state and federal aid working perhaps through local irrigation districts.

This entire question of the amount of agricultural development and of general industrial development as well, that might be brought about by the availability of cheap electric power, is of such transcendent importance to the states of Oregon and Washington as to justify its continued study on the part of the proper bureaus and public-spirited citizens and to call for the most careful consideration on the part of the legisla-

tive branches of our state and federal governments until the ends desired are finally attained.

Typical Analysis of Irrigation Pumping Problem.

Permissible lift for a 10,000 acre project devoted entirely to fruit culture and subdivided into 20 acre farm units.

It is here assumed that actual occupancy of the ranch by the owner does not begin until the sixth year, at which time the orchard begins to bear, and the owner erects his farm buildings and secures his stock and equipment. During the initial five years it is assumed that the place is cared for by hire.

Initial Investment—

Land and water rights including proportionate ownership of all irrigation works at \$100 per acre	\$2,000	
Fencing	200	
Clearing, leveling and farm laterals	500	
Plowing and planting to orchard	500	\$ 3,200

Investment at end of Fifth Year—

Initial investment as above	\$3,200	
Interest 6 per cent, taxes 1 per cent, = 7 per cent compounded annually for 5 years	1,300	
Depreciation of fencing, 5 years at 6 per cent.	60	
Cost of labor and material and pumping, less temporary crops, for 5 years, including interest and taxes compounded annually, say.	3,840	
Farm buildings exclusive of fencing	1,000	
Farm equipment (buggy, wagon and implements)	300	
Farm stock (team, one cow, chickens, etc.) ...	300	\$10,000

Annual cost after owner is living on place—

Interest 6 per cent, taxes 1 per cent = 7 per cent on \$10,000	700	
Depreciation of farm building and fences at 6 per cent	72	
Depreciation of farm equipment at 72 per cent	48	
Depreciation of stock at 8 per cent	24	
Fertilizer at 50c per acre	10	
Material for spraying and other treatments at \$10 per acre	200	
Extra labor and material for picking, packing and hauling fruit to warehouse at 37½c per box = \$75 per acre	1,500	
Allowance to rancher for his own labor	720	
Total exclusive of pumpage and canal maintenance	\$3,274	

Crop returns—

Average crop yield of 200 boxes of apples and pears per acre, with a net return to grower, after commissions and freight have been deducted, of 90c per box = \$180 per acre..\$3,600

	Per Acre.
Available for pumpage and canal maintenance, \$326 = \$16.30	
Cost of canal maintenance alone, say	0.65

Available for pumpage

Estimated cost of pumpage for 1000 ft. lift exclusive of power

Available for power

Estimated power consumption per acre per season, 3740

kw.-hr.

Cost per kw.-hr. = \$0.00326, which is practically the rate at which Celilo power can be delivered.

The returns from the fruit acreage on the Sunnyside Project in Washington, embracing as it does a considerable area of young orchard, amounted to \$219 per acre in 1912 and approximately that in 1913. Under the very abnormal conditions which exist this year, due chiefly to the European war, it will probably be less.

The action of waves on dam faces may cause much damage. On the Deer Flat reservoir of the Boise project it has been necessary to place gravel on the upper face. This was done after the completion of the dam by dumping large amounts of gravel at the top of the slope and letting it work down under the action of the water. The face was originally constructed on a slope of 3 to 1. On the Belle Fouché reservoir it was found that under heavy wave action the water which got behind the slabs of concrete paving could not get out sufficiently quickly when the waves receded. The pressure of this water caused the slabs, which were 5x6½ ft. and 8 in. thick, to move outward. This has been overcome by keying the slabs together.

ACTIVITIES OF SAN FRANCISCO ELECTRICAL CONTRACTORS.

BY C. F. BUTTE.

(This record of experience in conducting a successful local organization of electrical contractors and dealers should be suggestive of what may be done by others and of what yet remains to be done. It constitutes the report of the president of the local association to the California Association of Electrical Contractors and Dealers at their convention at Stockton, July 14, 15, 16, 1916.—The Editor.)

Before outlining any of the work that the San Francisco local has undertaken I want to emphasize the fact that no matter what has been discussed in our local, no matter what action has been taken and no matter what details I may enter into in making this report, all of our work has been along educational lines, along the lines that each member can benefit the other by his experiences, along the lines that each individual member must act in accordance with his best personal judgment, and that at no times do we countenance any combination to force others to act in accordance with such combination. I want it thoroughly understood by all present that the San Francisco local will not, has not, and cannot at any time agree upon, fix upon or determine any fixed price, charge or billing on any materials, work or labor and wherever I have referred to such matter in this report we have always considered and discussed such matters from the educational point of view and the experience of others in the proper guidance and handling of our business, all to be taken by the individual as he may see fit and applied as his own judgment may decide.

The work of the San Francisco local is entirely handled by committees appointed for each respective subject. Whatever success we may have attained is entirely due the respective committees and assisting members. At the present time we have several important matters under discussion that materially effect the industry and to which I shall refer later.

Legislative Committee.

The many questions that continually arise with the enforcement and application of our city ordinances and the many points that need to be clarified are all handled by our legislative committee consisting of Messrs. Hope, Porter and Smith.

This committee recently assisted in the revision and adoption of several important amendments to our present ordinances, in particular the question of switches in rooms with running water. Through their efforts and assistance in this matter switches are now required in all rooms with running water whether the fixture is in reach of the faucet or not, thus simplifying this previous contentious question.

This committee has also had a number of conferences on the question of local licenses. Mr. Hope has made an extensive report covering the number of firms and persons registered in the department of electricity, the cost of running the department for the year, and the possible amount from licenses that would be required to operate the department without additional inspection fees. As a result of this report a \$200 flat license per year was recommended.

The question of the use of flexible armored cable in lieu of conduit in construction work has been thoroughly taken up by this committee and after their report it was decided that flexible armored conductor shall be used only in remodeling work and not in new construction, or the use of this material shall be only allowed where the use of rigid conduit is impracticable. To further clarify the questions that are brought up to the department of electricity this committee in conjunction with Chief Barry and the standardization committee has compiled certain data directly effecting the installation work.

This committee now has under consideration the extent and limitation of the use of lead covered conductors in underground and under basement floor conduits.

Labor Committee.

This committee consisting of Messrs. Sittman, De Lew and Butte handles the matter of social insurance. While it may not appear important to the employer at this time, this question of social insurance is a factor that will have to be dealt with and as the industry must carry the burden it is well to fully acquaint ourselves therewith:

As generally defined, social insurance in addition to insuring the wage-earner against the loss resulting from industrial accident, gives him similar insurance against the disastrous results of sickness, invalidity, old age, unemployment and even death.

In this matter the state of California has taken the lead in the United States by establishing a Social Insurance Commission. This commission is required to make a study of the social insurance theory, to examine the European experiments with that theory, and to make a careful survey of the local conditions in the state of California with the end in view of reporting to the legislature as to the advisability of the state widening its activities in the field of social insurance which it has already initiated in its Workmen's Compensation Act.

Practically every European country has a sickness insurance system. Two distinct types have evolved: The voluntary subsidized scheme of Denmark, Sweden and Belgium and the compulsory system shown in its best developed form in Germany and England and found also in Austria, Hungary, Luxembourg, Russia, Roumania, Norway and Servia.

Germany compels the insurance of all wage workers and other employes whose earnings are below a certain level. When the difference in cost and standard of living in the two countries is taken into consideration, this level corresponds to an American income of \$1,200 a year.

The premiums for this insurance are paid two-thirds by the employe and one-third by the employer.

England also requires the insurance of all manual laborers and such other employes as earn less than £160 per annum.

The premiums are contributed to by the employe, employer and state in proportions of 4-9, 3-9 and 2-9, respectively. The German method of collecting from the employer, who reimburses himself for the employe's share by holding back part of the wages, has been followed in England.

The necessary premiums for a sickness insurance system in this country providing money benefits of two-thirds the wages during the period of disability, not to exceed 26 weeks in a year, similar benefits from 8 to 12 weeks in maternity cases, funeral benefits of about \$100 and medical and surgical benefits including the necessary drugs and hospital treatment, and allowing 10 per cent for administrative expenses, would total a little over 4 per cent of the wages.

Retail Committee.

It is with considerable pride that we can point to a live retail committee consisting of Messrs. Levy, Haverkamp, Keuhn and Scobey.

The latest activities of this committee cover a field pertinent to the future of the retail business. Through their efforts the retailers have under contemplation a publicity campaign to establish in the minds of the public that an exclusive retail electrical store is the proper place to purchase electrical materials and the proper place to obtain satisfactory service. Through individual subscription and whatever assistance the local can give, an advertising campaign will be started to induce the public to deal in an electrical store when purchasing electrical appliances and apparatus and not go to a drug store or similar places.

Uniform window dressing and displays have received considerable thought of this committee and to further the work, one evening each week a meeting is held in one of the retail stores. The work of this committee is entirely educational and to create confidence between all retail dealers. The activities of this committee have resulted in mutual assistance and the various retailers have reached the point where they do not refrain from telling any of their experiences in selling, buying, store methods and costs and at the meeting they now freely express their personal opinions on such matters.

Bidding Committee.

This committee, consisting of Messrs. Fortini, Newbery and Kohlwey, is at all times anxious to present at our meetings correct methods of figuring work, correct methods of presenting bids and correct ways of doing business.

Guarantee Committee.

Our latest undertaking is covered by this heading, namely guaranteeing the work of our fellow member by the collective interests thereby creating an incentive to the owner and architect to award the contracts to our membership. Mr. De Lew is now working on a tentative plan whereby all contracts in legal form taken by any member of the San Francisco local will be guaranteed and vouched for by the entire collective membership of this local. Not only will the completion of the contract be guaranteed but the quality and conforming to the specifications and plans as well. Also any disputes that may arise will be settled by the membership.

Harmony, confidence and good will between the owner or architect and the electrical contractor is the aim of this committee, thereby creating a desire on the part of the former to award the work to the progressive contractor.

Ethics Committee.

This committee, consisting of Messrs. Fortini, Levy and Reid, is now formulating a code of ethics covering the relationship between contractor and contractor, and his dealings with the customer. Much will be done by this committee to create further confidence and harmony between members and their customers and with the work of the guarantee committee we hope that the day will soon arrive when an owner or architect will embody in the specifications and requirements that all bidders must be in a position to qualify under the guarantee and ethic conditions.

HOW—

GENERAL FACTS, FIGURES AND THEORY

OF CURRENT INTEREST

HOW AUTOMOBILE COSTS ARE KEPT.

For the past several years, the Pacific Power & Light Company has kept an accurate statement as to the expense of its automobiles, and in February, 1915, there was printed in the Bulletin an analysis of these figures for the last half of the year 1914. We are presenting herewith a similar statement for the year 1915.

The theory that an automobile is a cheap means of transportation is not well founded. It is apparent from an examination of the statistics that in no case is automobile transportation for one man as cheap as railroad transportation and in many cases it is ten times as expensive. Of course, in considering this question, attention must be given to the matter of convenience and other important factors. As the number in the car increases, the cost by automobile is less.

Automobile Data for 1915.

Branch.	Make.	H.P.	Miles Run.	Average Miles per Day.	Gal. Gasoline.	Miles per Gal.	Qts. Oil.	Miles per Quart Oil.
Walla Walla.....	Ford	20	11,647	32.0	755	15.4	167	69.7
Sunnyside	Ford	20	14,495	39.7	900	16.1	288	50.1
Toppenish	Ford	20	9,288	25.5	540	17.2	206	45.0
Pasco	Ford	20	5,814	16.0	423	13.8	90	64.8
North Yakima....	Ford	20	10,670	29.3	700	15.3	77	139.0
North Yakima....	Gen.V. 2T		2,354	6.5	Elec.	*.51	Grease	....
Hood River.....	Loco.	32	5,472	15.0	992	5.5	275	19.9
Naches	Loco.	32	6,366	17.4	771	8.3	100	63.7
Walla Walla.....	Loco.	32	7,500	20.5	743	10.1	147	51.0
Astoria	Chev.	24	6,565	18.0	502	13.1	46	143.0
Irrigation	Ford	20	8,938	31.4	459	19.5	98	91.2
Dayton	Ford	20	13,362	43.8	827	14.9	124	99.5
North Yakima....	Over.	35	6,903	31.7	528	13.1	76	91.0
Vancouver	Cadl.	30	2,852	13.3	328	8.7	32	89.3
Prosser	Ford	20	1,600	20.2	136	11.8	15	107.0
Total			112,826	23.9	8604	+12.8	1741	+63.3

*Per kw.-hr. †Not including Electric Truck.

All the cars mentioned in tables operated for a full year, with the exception of the last five. The irrigation Ford operated for 284 days, the Dayton Ford operated for 282 days, the North Yakima Overland 218 days, the Vancouver Cadillac 214 days and the Prosser Ford 79 days. All other cars are charged with a full 365 days. In working up averages and other details, the actual number of days operated for the short-term cars has been taken into consideration.

Automobile Data for 1915.

Branch.	Make.	Cost Gasoline.	Cost Oil.	Repairs and Body.	Tires and Tubes.	Garage.	Misc.
Walla Walla...	Ford	\$137.96	\$32.90	\$97.51	\$197.85	.....	\$28.80
Sunnyside	Ford	153.31	42.24	168.50	251.20	\$40.00	136.50
Toppenish	Ford	83.48	19.91	157.77	100.14	.....	31.65
Pasco	Ford	65.19	18.20	116.95	86.20	.....	17.55
North Yakima..	Ford	106.43	9.19	109.71	113.30	12.50	22.20
North Yakima..	Gen.V.	*322.63	8.10	70.41	88.95	.....	12.35
Hood River....	Loco.	160.97	53.97	706.38	153.85	25.00	45.35
Naches	Loco.	114.73	12.48	164.82	221.21	.....	48.37
Walla Walla....	Loco.	132.30	18.60	250.66	170.74	16.60	48.54
Astoria	Chev.	63.34	7.48	210.94	140.85	38.00	9.10
Irrigation	Ford	73.56	15.88	34.51	69.80	4.60	12.53
Dayton	Ford	151.27	21.10	67.03	114.35	14.95	34.78
North Yakima..	Over.	83.79	10.24	20.03	110.85	.....	42.86
Vancouver	Cadl.	37.56	5.25	16.75	34.22	15.00	8.45
Prosser	Ford	27.23	1.75	.....	3.75	6.25	10.25
Total		\$1713.75	\$277.29	\$2193.97	\$1857.26	\$172.90	\$509.28

*Cost of energy for storage batteries at 7c per kw.-hr.

The energy used for the electric truck at North Yakima was charged at the rate of seven cents per kilowatt-hour. This is direct-current energy and it is believed that would be an average price that a private consumer would have to pay for it if he bought it from a public service company. All other details in the table are presumed to be self-explanatory. The difference

between the operating cost per mile and the total cost per mile is purely a question of depreciation, which is figured at 2 per cent a month on the original value of the car.

Branch.	Make.	Insur- ance.	Depre- ciation.	Total Expenses.	Operating Cost per Mile Cents.	Total Cost per Mile Cents.	Cost per gal. Gasoline. Cents.
Walla Walla....	Ford	\$45.35	\$146.40	\$ 686.77	4.63	5.93	18.3
Sunnyside	Ford	38.25	158.40	988.40	6.67	7.77	17.0
Toppenish	Ford	38.25	152.40	583.60	4.65	6.3	15.5
Pasco	Ford	39.75	156.00	499.84	5.88	8.55	15.5
North Yakima..	Ford	36.75	153.60	563.68	3.85	5.27	15.3
North Yakima..	Gen.V.	86.50	960.00	1,548.94	25.00	65.7	77.0
Hood River.....	Loco.	93.00	480.00	1,718.52	22.6	31.4	16.2
Naches	Loco.	93.00	480.00	1,136.61	10.3	17.8	15.0
Walla Walla....	Loco.	93.00	480.00	1,210.44	9.73	16.6	17.8
Astoria	Chev.	47.50	228.00	745.21	7.96	11.3	12.4
Irrigation	Ford	34.45	107.30	352.63	2.74	3.93	16.0
Dayton	Ford	34.20	101.20	538.88	3.54	4.35	18.3
North Yakima..	Over.	35.85	128.40	432.02	4.4	6.25	15.8
Vancouver	Cadl.	50.89	210.00	378.12	5.9	13.3	11.4
Prosser	Ford	9.56	26.26	85.05	3.7	5.3	20.0
Total		\$776.30	\$3967.96	\$11,468.71	6.65	10.2	+16.1

* Per kw.-hr. † Not including electricity.

FACTS AND FIGURES OF CURRENT INTEREST

The Nippon Yusen Kaisha, controlling a fleet of ships that called at certain Pacific Coast ports, during last year netted in profits \$5,259,303.

* * *

During the past ten years the registration of automobiles in various states has increased 5000 per cent, or from 48,000 in 1906 to 2,445,664 in 1915.

* * *

The Bureau of Census reports that in 1914 returns were received from 1284 establishments engaged in the gas industry and that their total products for the year were valued at \$220,237,781.

* * *

California has more automobiles in proportion to population than any other state in the union. In actual number this state ranks fourth with her 163,795 registrations in 1915 as opposed to Illinois, Ohio and New York with 180,832, 181,332, 231,831 respectively.

* * *

The ancients may have been correct in poetry and song concerning the great continent of Atlantis. Says an authority of the French Academy of Sciences: "No affirmation is yet permissible, but it seems more and more evident that a vast region, continental or made up of great islands, has collapsed west of the Pillars of Hercules, otherwise called the Strait of Gibraltar, and that its collapse occurred in the not far distant past. In any event, the question of Atlantis is placed anew before men of science."

* * *

California Good Roads enthusiasts are urging the setting aside of a "Good Roads" day during the Fall for the consideration and inspection of the system of beautiful state highways already completed. The work of good roads in California started four years ago with a bond issue of \$18,000,000, of which all but about \$2,000,000 has been expended. The last legislature voted an additional bond issue of \$15,000,000. The final vote of approval on the part of the citizens of the state is set for the November election.

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POWER AND GAS

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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The proposition to link the cities of Berkeley, Alameda, Oakland and San Francisco by a gigantic bridge has long been a matter of speculation and sincere yearning on the part of the thousands of commuters who daily travel back and forth between these sister cities. While the proposed bridge structure represents as a whole a magnitude of bridge engineering hitherto unattempted in constructive effort, still upon close analysis it is found that no unusual or untried features need be undertaken in its accomplishment. And best of all the data that are being gathered by the various civic bodies engaged in investigating the proposition goes to show that in spite of an estimated cost of twenty-two million dollars, the project will be a paying one from the start. The forty million passengers that annually cross on the ferry boats coupled with the enormous railroad and vehicle traffic make the proposition one that will undoubtedly pay for itself in from fifteen to twenty years.

While the San Francisco-Oakland bridge in some respects may be characterized as merely of local interest, yet from its broader aspects the entire West is vitally interested. A mammoth bridge uniting two growing communities will do far more than link together a people now numbering nearly a million by a physical structure of steel and concrete, but indeed it will serve as a link in binding the interests of all into one indissoluble unit.

The resultant good effect that is derived from the inter-linking of communities has long since been felt throughout the West due to the great hydroelectric networks that now thread its fertile valleys. The eight minute service to Oakland and the fifteen minute service to Berkeley are attractive features beyond measure, but the West congratulates the bay cities not so much upon these possible realizations from the bridge proposition as upon the impetus that is bound to result for still further forwarding the get-together spirit throughout our Western communities.

When you read that "the public's last great natural resource is being stolen by private spoilers, and enormously valuable water powers are being given away to power grabbers," you naturally wonder whether it may not all be so. You are doubtful and curious as to the truth in this insinuation and accusations that spring up like mushrooms in the editorial muck rooms. You are inclined to believe that the cited Forest Service reports showing monopoly and over development of water power in the Western states are correct.

Yet before passing final judgment is it not well to remember that this question, like all others, has two sides? The one which appeals to public passion and creates public prejudice has been given wide publicity; largely because it comes from supposedly disinterested sources. The other, based on common sense and reason, is seldom given due consideration, as it may be set forth by interested parties.

In matters of public welfare such as this reason should carry more weight than passion. Government reports and investigations are often made for purely

The Water Power Error

political purposes and in this respect the Forest Service report on water powers is no exception. Its avowed purpose was to discover the existence of monopoly and by inference to suggest its evil. By a mass of irrelevant data it bolstered up proof of what no one denied, —strongly centralized control of power development,—but ignores the fact that there is an economic necessity and benefit.

Analyzing this editorial's opening quotation which is a composite of statements made in the August number of a monthly magazine of national circulation, what are the facts? Are enormously valuable water powers being stolen by private spoilers?

Water idly tumbling from the heights is useless until harnessed. A power site, undeveloped is valueless. The use comes from the harnessing, the value from the development. Without capital for this development the water powers have no present value. Great financial risk is involved in this development and even under the most favorable conditions capital is chary of capture during the long term before a hydroelectric transmission system becomes profitable.

Before governmental restriction was placed on water power development the probable returns were sufficient to induce investment in projects which even yet have paid no dividends. The difficulties under which these most favored propositions have labored would have deterred investment in similar ones. With the added federal probabilities and the drastic action of regulating commissions, moneyed men simply refused to take the risk.

Water power developers are not private spoilers. Usually they have created the market to which their power is sold. They have established new industries, they have colonized tracts, and in this way contributed far more to the general prosperity and advancement of communities than to their own wealth.

A people's progress is measured by the amount of mechanical power utilized. The complex structure of modern civilization would collapse without the energy of steam, water and electricity. So, whatever influences the production of energy changes the state of civilization. Two great sources of energy are fuel and water. Fuel, once consumed, is slowly replaced. Water power renews itself continuously and indefinitely. The present consumption of coal and oil for power production frequently represents an enormous waste of energy that should be consumed for future needs.

With water power the conservation is the reverse of the case with fuel. With fuel non-use is conservation, with water full use is conservation. Coal miners may be spoilers, but water power developers are the highest type of conservers. Every kilowatt-year of hydroelectric energy utilized represents an actual saving of more than one long ton of coal burned under the most efficient conditions of modern steam power plant practice. Henry G. Stott of New York City, past president of the American In-

stitute of Electrical Engineers and a recognized authority on steam power, has stated that the hydroelectric power generated in this country represents a saving to posterity of twenty million tons of coal annually. Then should not the water power developer be encouraged in every way possible?

The fundamental mistake in handling the water power situation has been the failure to make this distinction between the conservation of fuel and of water. This mistake was founded in ignorance, but persists in error, ignorance being the not knowing of things, error the knowing of them falsely.

It has long been a matter of speculation as to the actual costs met with in public utility maintenance and operation in its automobile account. On another page of this issue may be found a detailed statement of costs in operation and upkeep of fifteen automobiles owned by the Pacific Power & Light Company during 1915. The total mileage of these cars was 112,826 and the total expenditures including insurance and depreciation \$11,468.71 which represents an average cost per mile of 10.2 cents. If consideration of the electric truck be neglected in the above figures, the passenger automobiles actually travelled 110,472 miles at a total cost of \$9919.77, averaging about nine cents per mile.

This compilation of data emphasizes two important features. In the first place in no case does an automobile with single passenger cover its distance as cheaply as can be done by modern railroad transportation. And in the second instance if a reasonable wage for the driver is to be added, as in the case of jitney transportation, it shows that the automobile still must struggle for increased efficiencies and lower costs of operation except in most favored instances in order to economically displace the modern steam railroad systems or the electric train for passenger traffic.

As to the mobility and freedom of action in the case of the automobile when compared with any other known source of transportation the former must be given the unquestioned supremacy. That the horse is now being practically displaced in rural communities for passenger transportation and indeed for all farm duties can no longer be denied.

It must be admitted too, that the transportation situation is at present in a state of flux. In the rural communities the automobile and tractor are not only displacing the horse for farm conveyance in general but in many communities the passenger and freight traffic of long established steam and electric lines are beginning to feel the effects of this new trend of modern evolution in transportation.

The future alone can, however, determine the much mooted question of the economic advantage of transportation by automobile as compared with the steam roads or with electric traction.

Cost of Autos for Utility Companies

PERSONALS

C. G. A. Baker, vice-president and treasurer Baker-Joslyn Company, is at Seattle.

A. Morbio, electric truck specialist with Great Western Power Company, is at San Diego.

J. M. Chamberlain, salesman Fobes Supply Company, has returned to Portland from San Francisco.

Jos. Sachs, inventor of the "Noark" fuse, expects to be at San Francisco August 17th from Hartford, Conn.

G. Douglas Jones, electrical engineer California State engineer's office, was at San Francisco this week.

L. J. Moore, load dispatcher San Joaquin Light & Power Corporation, is spending his vacation at San Francisco.

G. R. Wright, sales agent with the Canadian General Electric Company, is at San Francisco from Vancouver, B. C.

F. C. Heoppner, manager Bertram Bros. Electric Company, has returned to Phoenix, Ariz., from Los Angeles.

W. L. Goodwin, vice-president, in charge of sales Pacific States Electric Company, motored to Lake Tahoe this week.

W. R. Pigg, of Berkeley, Cal., has been elected vice-president and treasurer of the Central California Gas Company.

E. A. Weymouth, assistant manager Pacific Gas & Electric Company at Sacramento, was at San Francisco this week.

A. R. Marvin, salesman with the Pacific States Electric Company at Portland has been called east by the death of his father.

E. A. Quinn, general superintendent San Joaquin Light & Power Corporation, has returned to Fresno from San Francisco.

D. E. Harris, sales manager San Francisco office Pacific States Electric Company, has returned from a two months' trip East.

Geo. Bernhard, assistant manager Great Western Power Company at Sacramento, has returned from a visit to San Francisco.

Fred Hamilton, superintendent Western division Mt. Whitney Power & Electric Company, was at San Francisco this week from Visalia.

H. A. Case, salesman with San Francisco office Western Electric Company, has returned from a two weeks' vacation at Willits, Cal.

J. R. Baker, general auditor of the lamp works of the General Electric Company, was at San Francisco during the past week on business.

W. G. Stearns, sales agent with San Francisco office Standard Underground Cable Company, has returned from two weeks at Santa Rosa.

Ross Hartley, manager Portland office Pacific States Electric Company, is spending several weeks on a vacation trip in the mountains of Oregon.

S. P. Russell, manager electrical department H. W. Johns-Manville Company at San Francisco, is making an automobile tour to Crater Lake, Oregon.

M. S. Orrick, Western Electric Company, San Francisco, expects to leave this week for Yosemite Valley and Lake Tahoe via the newly-opened Tioga road.

L. A. Nott, assistant manager San Francisco office Standard Underground Cable Company, has returned from a three weeks' business and pleasure trip through the Sierras.

F. D. Fagan, manager Edison Lamp Works at San Francisco, and **M. H. Schnapp**, meter specialist General Electric Company, are making an automobile trip to Yosemite Valley.

J. B. Rowray, superintendent of the Northern Electric Railway Company at Chico, has been appointed to the office of general manager made vacant by the death of William McGovern.

R. E. Fisher, commercial department Pacific Gas & Electric Company, has returned to San Francisco from the mines of Nevada county.

J. C. Stone, assistant traffic manager for the Northern Electric Company, was married on the evening of July 14th. Mr. and Mrs. Stone, having spent their honeymoon at Princeton-by-the-Sea, are now back at Sacramento.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has issued an order approving a trust deed by the Martinez & Concord Interurban Railway Company to secure an issue of \$200,000 of first mortgage six per cent 25 year bonds.

The commission has issued a supplemental order authorizing the Inglewood Water Company to sell \$13,000 face value six per cent first mortgage bonds at 95 per cent, to refund indebtedness.

The commission has authorized the Nevada-California-Oregon Telephone & Telegraph Company to issue \$15,000 face value six per cent bonds at not less than 80 per cent.

The commission has authorized the Visalia Electric Railroad Company to issue 460 shares of its common stock, par value of \$100 a share, to the Southern Pacific Company.

The commission has authorized W. F. Boardman, Charles F. Legee and William C. Crittenden to sell to Newport Beach their gas distributing system for \$1773, certain real estate for \$3000 and to lease property at \$250 a month pending sale.

The Santa Paula Water Company has applied to the commission for authority to issue promissory notes for not more than \$10,000 for from one to five years at not more than 7 per cent.

The Economic Gas Company of Los Angeles has applied to the commission for an extension of time until June 30, 1917, to sell \$262,000 of its five per cent bonds.

The Irwin Heights Water Company has filed with the commission an application for authority to sell its water system to the city of Santa Monica for \$75,000.

The commission has issued a supplemental order authorizing the Economic Gas Company to issue \$262,000 face value 5 per cent bonds to be sold for corporate purposes. The bonds are to bring not less than 83 1-3 face value.

TRADE NOTES.

H. B. Squires Company of San Francisco have been re-appointed Pacific Coast agents for Matthias Klein & Sons of Chicago.

The San Francisco offices of Allis-Chalmers Manufacturing Company have been removed from the southwest corner of New Montgomery and Mission streets to suite 741-751, Rialto building.

Benjamin Electric & Manufacturing Company are handling the sale of Dimalites for the Wirt Company of Germantown, Pa. **F. H. Poss**, Pacific Coast manager, has a large stock at San Francisco and advises that an extensive advertising campaign is planned.

The **Lyman Electric Company** have recently opened a new fixture and repair shop at 106 North California street, Stockton. The new place has been fitted up like a beautiful reception room, making a cozy appearance and no doubt will prove most attractive to the women purchasers of lighting fixtures and appliances.

The capital stock of the **Morse Chain Company** of Ithaca, New York, has lately been increased from \$400,000 to \$1,500,000 for expansive purposes in the shape of new buildings and additions to old ones already under way. Present plans contemplate again doubling the size of the plant, a large storage building being about completed, additions to the steel and wire mills and a new gas producer building being well under way, and another large addition to the main building, increasing its total length to more than 900 ft., soon to be started.

RECENT TESTS ON STEEL BEAMS AND GIRDERS.

The engineering experiment station of the University of Illinois, in Bulletin No. 86, has recently set forth new test data on structural strength of I-beams and girders that adds new light in design, especially in considering stresses that cause buckling of girders as opposed to straight failure due to crushing.

DETERMINATION OF CONTRACTORS' OVERHEAD.

The Electrical Contractors' and Dealers' Association of San Francisco have appointed a committee to obtain the actual overhead costs of doing business of each member. Upon completion of this report an average will be taken, and every member will then know what per cent he should add to the cost of his labor and material before his percentage of profit is added. This report will appear later.

CIVIL SERVICE EXAMINATION.

The United States Civil Service Commission announces an open competitive examination for electrical draftsman, for men only. From the register of eligibles resulting from this examination certification will be made to fill several vacancies in this position in the New York Navy Yard at salaries ranging from \$3.52 to \$6 per diem, and vacancies as they may occur in positions requiring similar qualifications, at any navy yard or other naval establishment of the United States or in the Department at Washington, unless it is found to be in the interest of the service to fill any vacancy by reinstatement, transfer or promotion.

BOOK REVIEWS.

Ozone, Its Manufacture, Properties and Uses. By A. Vosmaer, Ph.D.; 197 pp.; 6x9 in.; 70 illustrations. Published by D. Van Nostrand Company, New York, and for sale by Technical Book Shop, San Francisco. Price \$2.50.

The subject of ozone is one of great variety; it involves chemistry, physics, bacteriology, hygiene, industrial chemistry, electrical and mechanical engineering. The treatment of this important subject as set forth in this book is covered under three main headings: The nature of ozone, the manufacture of ozone, and the uses of ozone. In the main, the work details the author's experience as a chemical and electrical engineer covering some fifteen years' experience in investigations and practical applications of ozone.

The book will serve as an excellent guide for those interested in the subject matter treated.

Electric Wiring Diagrams and Switchboards. By Newton Harrison, E. E., with additions by Thomas Poppe; 303 pp.; 5x8 in.; 130 illustrations. Published by the Norman W. Henley Company of New York, and for sale by the Technical Book Shop, San Francisco. Price \$1.50.

The first edition of this work appeared in 1906. During the ten years that have elapsed the ever increasing use of transformers and measuring instruments has led to the inclusion of these two important subjects in the matter treated. The strong feature of the book is its extremely clear method of presentation. The author inductively leads the reader step by step in such a manner as to wean the wireman away from the use of text books and other references, thus making him able to calculate voltage drops and find the required circular units of wire without a table.

Theory and Calculation of Alternating-Current Phenomena. By Charles Protens Steinmetz, A. M., Ph. D.; 480 pp.; 6x9 in.; 220 illustrations. Fifth edition; thoroughly revised and entirely reset. Published by McGraw-Hill Book Company, Inc., New York, and for sale by Technical Book Shop, San Francisco. Price \$4.00.

The works of Dr. Steinmetz are too well known and too highly valued by the electrical engineering profession to elaborate here on the strong features of this book. Suffice it to say that this present work constitutes the first of three volumes which will represent in a thoroughly revised and

entirely reset form the fifth edition of the author's "Alternating-Current Phenomena," which first appeared nearly twenty years ago. In this present volume is included only the discussion of the most common and general phenomena and apparatus, old and new, revised and expanded so as to bring it up to our present knowledge.

In the present edition of "Alternating-Current Phenomena" the crank diagram of vector representation, and the symbolic method based on it, which denotes the inductive reactance by $Z = r + jX$, have been adopted in conformity with the decision of the International Electrical Congress of Turin.

NEW CATALOGUES AND BOOKS RECEIVED.

"The Insulator Book," a publication by the Locke Insulator Manufacturing Company, of New York, has just made its appearance. The book has 184 pages and is replete with illustrations.

Trolley Line Material, including clinch bars, trolley splicers, frogs and suspensions, are described and illustrated in descriptive leaflet No. 3881 just issued by the Westinghouse Electric & Manufacturing Company.

"The Economy Produced by Using Reversing Planer-Motors on Machines Having Reciprocating Motion" is the title of descriptive leaflet (No. 3554-A) just issued by the Westinghouse Electric & Manufacturing Company, in which this subject is thoroughly discussed, illustrations and a summary of machine tool operating expense given.

The publishers of this book are manufacturers and engineers of high voltage insulators and other electric power line specialties. The book gives a compilation of data and specifications for high voltage installations gathered from a wide range of authoritative sources. After briefly reviewing the history of high voltage transmission, there follow discussions of mechanical construction, minimum spacings, general specifications for steel towers, poles, wires and cables, details of design, cross-arms, inspection and a horde of other useful information. The illustrations throughout are excellent. For anyone interested in the subject of high voltage transmission, the book should receive a cordial reception on the book shelf reserved for practical reference on standard design and specification.

TRANSMISSION.

BOISE IDAHO.—The substation of the Federal reclamation service was destroyed by fire. Mr. Harris was overseer of the plant.

WOODLAND, CAL.—The board of supervisors has granted the Northern California Power Company a franchise to transmit electric current along the highways of this county.

GRASS VALLEY, CAL.—The Pacific Gas & Electric Company has awarded a contract for the immediate raising of Lake Spaulding dam 35 ft. The contract has been let to Tucky Brothers.

AUBURN, CAL.—An agreement has been reached between the Placer County Land Company of this city, and the Pacific Gas & Electric Company, giving the latter a right of way across the property of the land company.

CARSON, NEV.—Work has commenced on the new power plant to be built on the Carson River near Gardnerville by the Douglas Mining & Power Company. The survey and preliminary work on the ditch line has been completed and the construction of the mile of ditch has started.

SANTA FE, N. M.—Another step toward furnishing of electric current to Albuquerque, Santa Fe and Las Vegas from the waters of the Rio Grande in White Rock canyon, has been taken. The capital of the company has been increased from \$1,000,000 to \$3,000,000. Final plans for the dam and power plant have been filed with the state engineer and must be approved before the company can proceed. The initial cost of the project is estimated at \$1,933,615.



NEWS NOTES



INCORPORATIONS.

TEMPE, ARIZ.—Darling's Electric Vaporizer Company has filed articles of incorporation with a capital stock of \$10,000. The incorporators are L. H. Darling and H. M. Porter, both of Los Angeles. The principal place of business will be Phoenix, with a branch office at Los Angeles, Cal.

ROSWELL, N. M.—Articles of incorporation have been filed by the Lincoln County Light & Power Company of Parsons. The capital is \$150,000 and the incorporators are: J. H. Fulmer and Geo. H. Fuller of Chicago; A. T. Graham of South Bend, Ind.; Geo. L. Ulrick of Carrizozo, and A. T. Anderson.

ILLUMINATION.

FORT BIDWELL, CAL.—The Bidwell Electric Company has been granted a franchise to operate an electric light and power system here.

LOS ANGELES, CAL.—The city council has ordered the installation of necessary appliances for lighting Hollywood boulevard between Wilcox and Cherokee avenues.

POMONA, CAL.—Eight cities in Pomona and San Gabriel valleys will be served with natural gas within ten months, according to the plans of the Southern Counties Gas Company.

LOS ANGELES, CAL.—The board of supervisors has granted the request of the Homeward Avenue Lighting District Lighting Committee for furnishing globes through the mechanical department.

BOISE, IDAHO.—The public utilities commission has granted a certificate of public convenience and necessity to the Utah Power & Light Company to furnish electric service to the village of Lava Hot Springs.

HAYWARD, CAL.—A new lighting system of electroliers in place of the present lighting will probably be installed in this city, following an investigation made by the committee appointed by the Chamber of Commerce.

MYRTLE CREEK, ORE.—The city council has ordered notices posted calling for a special election to be held on August 26th to vote on a bond issue of \$27,000 for the construction of a municipal electric light system. Plans were submitted by M. B. Germond, engineer for the project.

OAKLAND, CAL.—The Pacific Gas & Electric Company has purchased the southwest corner of Seventeenth and Clay streets, 50x100 ft., for \$100,000. The company will build a class A 8 story building, which it hopes to occupy within one year, plans for the structure having already been drawn up.

SEATTLE, WASH.—Superintendent J. D. Ross of the city lighting department, states that two substations will be constructed, one at the present city plant on Stoneway and Fremont and the other at Ballard near Twenty-second avenue and Vernon place. The buildings will cost about \$75,000. Plans will be prepared later by Daniel Huntington, city architect.

LOS ANGELES, CAL.—The Economic Gas Company has filed suit against the Southern California Gas Company for damages in the sum of \$67,233. The suit is the outgrowth of an alleged contract entered into between the two companies October 26, 1912. Under this purported contract the Southern California Gas Company is alleged to have obligated itself to furnish natural gas to the Economic Company, from April 1, 1913 to September 1, 1932.

IRRIGATION.

TWIN OAKS, CAL.—W. H. Bissell expects to have an irrigation plant in operation shortly which will enable him to pump 10,000 gallons an hour.

WEAVERVILLE, CAL.—Manager Roscoe J. Anderson of the Northern California Counties' Association is making an investigation of the Hayfork Valley, where an irrigation system to water 27,000 acres has been suggested.

LINDSAY, CAL.—The board of directors of the Lindsay-Strathmore Irrigation District will receive bids up to August 14th, for the construction of irrigation works for the district. The work to be done embraces 37 wells and well pumping plants.

SACRAMENTO, CAL.—As a result of a decision handed down by Superior Judge Peter J. Shields in a suit brought by the Capital Banking & Trust Company, as trustee for the bondholders against the American Irrigation Company, the Fair Oaks, Citrus Heights and Carmichael Colony distributing system, owned by the irrigation company, will be sold to the bondholders and undergo extensive improvements. The system will be sold to satisfy a prior claim of the North Fork Ditch Company of \$19,700 for water supplied the American Irrigation Company. All in excess of that sum will go to liquidate the bonds.

PLACERVILLE, CAL.—Property owners in the proposed Diamond Ridge Irrigation District in this county, in session here voted to hold meetings in the district for the organization of the property owners therein. The district embraces 85,000 acres, 60,000 acres of which will be irrigated under the results of investigations conducted by engineers for the Diamond Ridge Ditch Company.

BUTTE VALLEY, CAL.—The Butte Valley Land Company, which owns a tract of 25,000 acres in Butte Valley, Plumas county, and has a lease on an adjoining tract of 16,000 acres, is constructing an irrigation system which will water 10,000 acres at a cost of \$75,000. The remainder of the tract will be irrigated by wells, many of which are in operation throughout the valley.

IRRIGATION, CAL.—David Blankenhorn, of the Blankenhorn-Hunter Company of Pasadena, was the only bidder for the issue of the \$210,000 bonds for the improvement of the Stinson-Burrell Reclamation District No. 1605. According to Trustees L. A. Nares, C. L. Adams and J. R. Erskine of the reclamation district, this is the first time in the history of California that par has been bid for an issue of bonds for reclamation purposes.

LOS ANGELES, CAL.—The first step toward solving the problem of the conservation and utilization of water which goes to waste in the various canyons in Southern California was begun when the Forest Service started a concrete base work for the establishment of a network of water stage recorders. The first of these water measuring devices will be installed in Santa Anita Canyon. Later, water recorders will be put in San Antonio, San Dimas, San Gabriel, Monrovia, Millard, Arroya, Big Tejuanga, Pacoima and Big and Little Santa Anita Canyons. According to authorities, water which now goes to waste in these canyons, could be used for irrigation and other work.

SALEM, ORE.—In co-operation with John T. Whistler, or the United States Reclamation Service, John H. Lewis, State Engineer, has just completed the preparation of plans and estimates of cost for the reclamation of 60,000 acres of land in Warner Valley in Lake county, and of 36,000 acres along White River in Wasco county. Under the Warner Valley project, it is proposed to drain a large area of swamp lands in that section so that 33,000 acres can be irrigated by gravity and 27,000 acres by pumping in the south end of the valley. It is estimated that the development will cost \$1,726,000, or approximately \$29 an acre.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
6

Gang Boxes—Each.

	Cost.	List.	Sell.
P. B. 2.....	\$ 0.90	\$ 0.90
P. B. 3.....	1.35	1.35
P. B. 4.....	1.80	1.80
P. B. 5.....	2.35	2.35
P. B. 6.....	4.55	4.55
P. B. 7.....	7.30	7.30
P. B. 8.....	7.90	7.90
P. B. 9.....	8.80	8.80
P. B. 10.....	9.60	9.60

Loom Switch Boxes

Single .....	.....	.30	.30
2-gang .....	.....	.50	.50
3-gang .....	.....	.75	.75
4-gang .....	.....	1.00	1.00
5-gang .....	.....	1.25	1.25
6-gang .....	.....	1.50	1.50
W. P. Box, complete with receptacle	4.50	4.50

Letter Boxes.

Letter Boxes	3.00	3.00
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Rigid Metallic Unlined Conduit.

Per 100 feet.

Size.	Cost.	List.	Sell.
1/2 in.	\$ 8.50	\$ 8.50
3/4 in.	11.50	11.50
1 in.	17.00	17.00
1 1/4 in.	23.00	23.00
1 1/2 in.	27.50	27.50
2 in.	37.00	37.00
2 1/2 in.	58.50	58.50
3 in.	76.50	76.50
3 1/2 in.	92.00	92.00
4 in.	109.00	109.00

Flexible Metallic Conduit and Fittings.

	Cost.	List.	Sell.
3/8", per 100 feet.....	\$10.00	\$10.00
1/2", per 100 feet.....	15.00	15.00
3/4", per 100 feet.....	20.00	20.00
1", per 100 feet.....	30.00	30.00
90 deg. 1/2" Connector, per 100.....	12.00	12.00
45 deg. 1/2" Connector, per 100.....	12.00	12.00
90 deg. 3/4" Connector, per 100.....	17.00	17.00
45 deg. 3/4" Connector, per 100.....	17.00	17.00
3/8" Connector, per 100.....	7.50	7.50
1/2" Connector, per 100.....	7.50	7.50
3/4" Connector, per 100.....	9.50	9.50
1" Connector, per 100.....	14.00	14.00

The correctness of these suggested selling prices is not guaranteed by the publisher.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
5

Boxes and Covers.
(continued.)

	Cost.	List.	Sell.
48-S. Flush steel cover for No. 17 box	\$10.00	\$10.00
48. Flush brass cover for No. 17 box	50.00	50.00
50. Closed steel cover.....	9.00	9.00
51. Outlet cover	10.00	10.00
50-B. Cover with 3/8" insulated bushing	12.00	12.00
15. Square outlet, switch or junction, straight electric, 4" square, 1 1/2" deep, 8 outlets in side and 5 in bottom, for 1/2" or 3/4" conduit.....	30.00	30.00
1900. Square outlet, switch or junction box for combination gas and electric fixtures, 4" square, 1 1/2" deep, 8 conduit outlets in sides for 1/2" or 3/4" conduit and 1 gas outlet in each of two opposite sides for 1/2" gas pipe.....	30.00	30.00
22. Open canopy cover for No. 1900 box	20.00	20.00
22-L. Open cover with ears for No. 1900 box	20.00	20.00
23. Closed cover for 1900 box.....	20.00	20.00
For Nos. 15 and 1900 Boxes.			
35. Open canopy cover.....	14.00	14.00
35-L. Open cover with ears	14.00	14.00
35-A. Closed cover (raised center)	14.00	14.00
37. Cover for standard push button or rectangular base switches or flush plug receptacles.....	20.00	20.00
37-A. Shallow cover for standard push button or rectangular base switches or flush plug receptacles	20.00	20.00
38. Cover for 2-gang plate for standard push button or rectangular base switches or flush plug receptacles	25.00	25.00
38-A. Shallow cover for 2-gang plates for standard push button or rectangular base switches or flush plug receptacles	27.00	27.00
52. Cover with 3/8" insulated bushing	18.00	18.00
11-B. Square outlet junction and switch box 4 11/16" square, 1 5/8" deep, 8 outlets in sides and 5 in bottom, for 1/2" or 3/4" conduit	40.00	40.00
*11-B. Deep 4 11/16" square, 2 1/4" deep, 8 outlets in sides and 5 in bottom, for 1/2", 3/4", or 1" conduit. No bottom outlets are provided in boxes for 1" conduit.....	50.00	50.00

The correctness of these suggested selling prices is not guaranteed by the publisher.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page preceeding

- | | |
|--|---|
| A-1 American Ever-Ready Works of National Carbon Co.
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland.
Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco;
Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson. |
| A-2 Atchison, Topeka & Santa Fe Railway Co.....
673 Market St., San Francisco; 1218 Broadway, Oakland. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| B-1 Baker-Joslyn Company..... 3
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles. | N-6 National Carbon Company.....
Cleveland, Ohio. |
| B-2 Benjamin Electric Manufacturing Co..... 5
590 Howard St., San Francisco. | N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco. |
| C-1 Century Electric Co..... 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore. | N-3 National Lamp Works of G. E. Co..... 4
(All Jobbers.) |
| C-3 Crocker-Wheeler Co..... 4
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles. | N-4 New York Insulated Wire Co..... 12
629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles. | N-5 Northwestern Pacific Railroad.....
808 Phelan Bldg., San Francisco. |
| D-4 Davis Slate & Manufacturing Co.....
Chicago, Ill. | O-1 Okonite Co. (The)..... 12
(All Jobbers.) |
| D-2 Dearborn Drug and Chemical Works..... 11
355 East Second St., Los Angeles; 301 Front St., San Francisco. | P-1 Pacific Electric Manufacturing Co.....
80 Tehama St., San Francisco. |
| E-7 Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago. | P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle. |
| E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles. | P-4 Pelton Water Wheel Co..... 11
2219 Harrison St., San Francisco. |
| E-2 Edison Storage Battery Supply Co..... 11
441 Golden Gate Ave., San Francisco. | P-5 Pierson, Roeding & Co..... 12
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle. |
| E-3 Electric Agencies Co.....
247 Minna Street, San Francisco; Central Building, Los Angeles. | P-6 Pittsburgh Electric Specialties Company.....
202 Aronson Bldg., San Francisco. |
| E-6 Electric Novelty Works.....
533 Mission St., San Francisco. | P-7 Pittsburgh Piping & Equipment Co..... 12
Monadnock Bldg., San Francisco. |
| E-4 Electric Storage Battery Co..... 3
743 Rialto Bldg., San Francisco. | S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco. |
| E-5 Electric, Railway & Manufacturing Supply Co..... 11
34 Second St., San Francisco. | S-4 Southern Pacific Co..... 4
Flood Bldg., San Francisco. |
| F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission St., San Francisco; Seattle; Spokane. | S-5 Sprague Electric Works..... 3
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane. |
| F-3 Federal Sign System (Electric).....
618 Mission St., San Francisco. | S-6 Standard Underground Cable Co..... 3
First National Bank Bldg., San Francisco; Hibernia Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815 Newhouse Bldg., Salt Lake City, Utah. |
| G-1 General Electric Co..... 10
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane. | T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives. |
| G-1 General Vehicle Co.....
1117 Van Ness Ave., San Francisco; 331 Wall St., Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C. | T-2 Tubular Woven Fabric Company.....
Pawtucket, R. I. |
| H-1 Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.) | U-1 United Sheet Metal Works.....
575 Howard St., San Francisco. |
| H-2 Hemingray Glass Co..... 11
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco. | W-1 Wagner Electric Manufacturing Company.....
St. Louis, Mo. |
| H-3 Haller-Cunningham Electric Co.....
428 Market St., San Francisco. | W-2 Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore. |
| H-5 Hunt, Mirk & Co.....
141 Second St., San Francisco. | W-3 Ward-Leonard Electric Co..... 12
Mt. Vernon, New York. |
| H-7 Hurley Machine Co..... 2
New York and Chicago. (See Pacific States Electric Co.) | W-4 Westinghouse Electric and Manufacturing Co.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane. |
| I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles. | W-5 Westinghouse Machine Co.....
141 Second St., San Francisco. |
| I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco. | W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.) |
| L-1 Leahy Manufacturing Co.....
Eighth and Alameda St., Los Angeles. | W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles. |
| L-2 Locke Insulator Manufacturing Co..... 12
(See Pierson, Roeding & Co.) | |
| M-2 McGlaughlin Manufacturing Co.....
Sunnyvale, Cal. | |
| M-4 Morse Chain Company..... 6
Monadnock Bldg., San Francisco. | |

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXVII NO. 7

SAN FRANCISCO, AUGUST 12, 1916

PER COPY, 25 CENTS

PUMPING PLANTS FOR RICE IRRIGATION.

BY C. F. ADAMS.

NAVIGABILITY OF COLUMBIA AND SNAKE RIVERS.

BY MAJOR J. J. MORROW.

FORMULAS FOR COMPUTING SKIN EFFECT.

BY CLEM A. COPELAND.

FINAL REPORT ON COLUMBIA RIVER POWER
PROJECT.

BY BOARD OF REVIEW.

STANDARDS FOR ELECTRIC SERVICE.

BY U. S. BUREAU OF STANDARDS.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries

Edison Storage Battery Co.

Boiler Feed Water Treatment

Dearborn Chemical Co.

Brushes

National Carbon Co.

Conduit and Cable

Sprague Electric Co.

Electric Washing Machines

Pacific States Electric Co.

Electrical Supplies

Electrical Ry. & Mfrs. Supply Co.
Pacific States Electric Co.

Feeder Voltage Regulators

Westinghouse Elec. & Mfg. Co.

Insulators

Hemingray Glass Co.
Pierson, Roeding & Co.
Thomas & Sons Co.
Locke Insulator Mfg. Co.

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The Okonite Co.
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Thor CUSTOMER GETTERS

*Quality and Service
built into the*

Thor
*Electric Washing
Machines*

and

Vacuum Cleaners

*make Thor friends—
the best Salesmen*

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PACIFIC STATES ELECTRIC CO.

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SAN FRANCISCO SEATTLE

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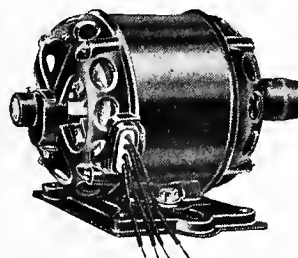
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Seattle

San Francisco

353 East Second St.
Los Angeles

5 or more — Less than 3 — WHICH?



Formerly you had to install motors which required from 5 to 6 times full load current to start (and you put them on the lighting circuits)—But what could you do, there were no others **then**.

But **now** you can get the fractional horse power

Century

SINGLE PHASE MOTORS

Repulsion Starting Induction Running
($\frac{1}{10}$ to $\frac{1}{4}$ H. P.)

They require less than 3 times full load current to start and develop a starting torque of 3 to 4 times full load torque.

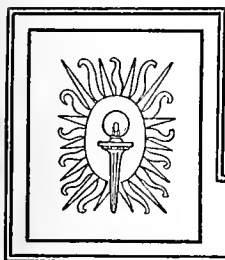
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after they reach full speed.*

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19th, Pine to Olive Streets, St. Louis, Mo., U. S. A.

Western Sales Offices and Stocks at San Francisco, Portland, Los Angeles, Seattle, Spokane, Salt Lake City

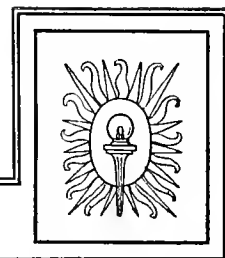
Member Society for Electrical Development—Do It Electrically 224



JOURNAL OF ELECTRICITY

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VOLUME XXXVII

SAN FRANCISCO, AUGUST 12, 1916

NUMBER 7

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Willow Creek Pumping Station.

PUMPING PLANTS FOR RICE IRRIGATION

BY C. F. ADAMS.

Along the west side of the upper Sacramento River there is developing a new industry which promises to provide a power load that will use the total capacity of the present electric service in this district. This is the industry of rice growing. The "rice-belt" covers an area which is estimated at from 70,000 to 80,000 acres, and the average power consumption will be about 150 h.p. per thousand acres.

The topography of this country is interesting, being the result of the surface wash from the western mountain slopes, combined with the silt deposited from the areas that are naturally flooded by the Sacramento River. The wash from the hills has created a plain, 15 to 20 miles in width, having a slope of three to ten feet to the mile toward the river. The great annual flood of the river has tended to raise the river bed and also its banks by sedimentary deposits. This action of the river has built up a strip of land about three miles in width on either side of the river, which slopes back with a grade of three feet to the mile.

The point where the river slope meets the western hill slope is known as the "Trough," and it constitutes a natural over-flow and flood channel parallel to the river course.

The pioneer rice development in the "Trough" is operated by the Rice Land & Products Company, who have 6000 acres under cultivation. In planning their

irrigation system, the canals were so located as to use both the waters of the Sacramento River and the drainage waters in the "Trough."

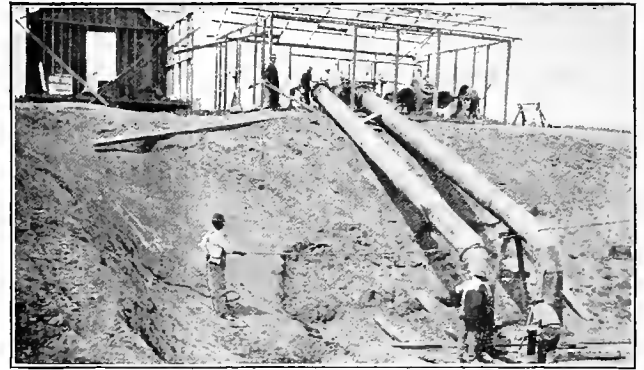
Pumping plant No. 1, known as the "River plant," is located on the Compton ranch about four miles from Princeton and nine miles from Colusa. The river at this point has a maximum variation in depth of about 26 ft. The pumps and motors, which are direct connected, are located in a concrete pit protected by the river levee, and about ten feet below the normal ground level. During high water period there is a static head of about eight feet on these pumps. The discharge pipe valves can be opened so as to fill the canals without pumping.

During the pumping season the actual water lift varies from six to eighteen feet. This water is discharged into a concrete forebay and then flows through the main canal straight west for a distance of 3.3 miles crossing the channel of Willow Creek at grade. A small overflow wier arrests the waters of Willow Creek and the second pumping plant handles the total flow of both streams. About five hundred acres are irrigated from the main canal before it reaches Willow Creek.

Pumping plant No. 2, known as the Willow Creek plant, lifts the water seven feet to a new canal level. This canal, which has a base width of sixteen feet and



Thrashing the Rice Harvest.



Suction Pipes at Willow Creek in Course of Construction.

a depth of four feet six inches, continues west two miles, to pumping plant No. 3, where a similar lift is made. The main canal is located along the northern line of the rice fields and the laterals are carried south a distance of three and one-half miles.

The equipment of the pumping plants is as follows:

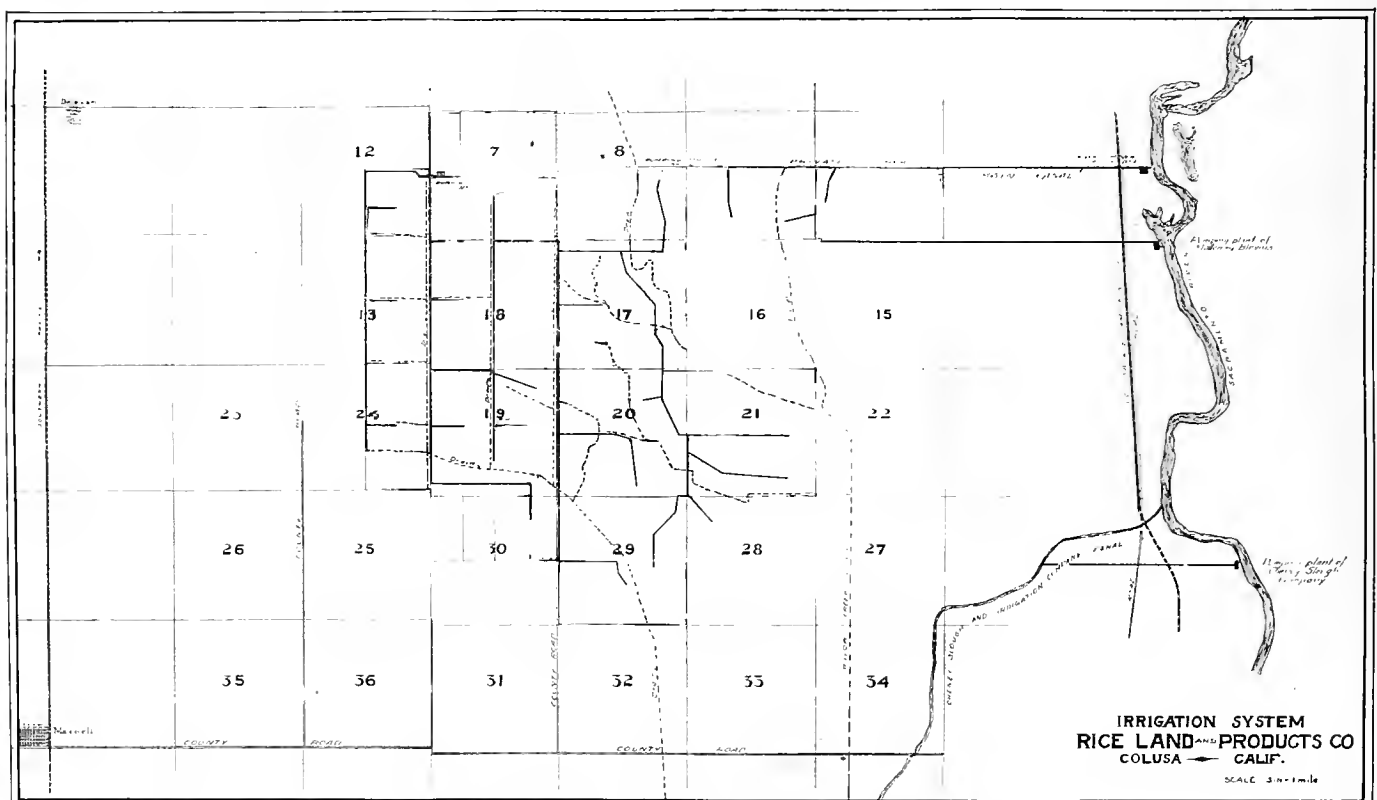
Plant No. 1.	
Pumps.	Motors.
1916—2-24 in. Worthington.	2-150 h.p. Westinghouse.
1917—1-36 in. Worthington.	1-250 h.p. Westinghouse.
Plant No. 2.	
1916—2-24 in. Worthington.	2- 75 h.p. Westinghouse.
1917—1-35 in. Worthington.	1-150 h.p. Westinghouse.
Plant No. 3.	
1916—1-36 in. Byron Jackson.	1-100 h.p. Westinghouse.

In plants No. 1 and No. 2 a Worthington wet vacuum priming pump is used and in Plant No. 3 a Baker Hanson priming unit is employed.

The electric power is procured from the transmission lines of the Northern California Power Company Consolidated. Their main substation is located along the Princeton road. Two banks of transformers are installed. One bank, 60,000/2200, operates the

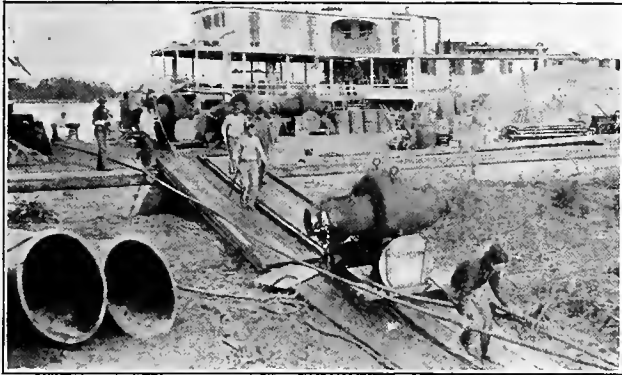
River Plant and the plant of Mallon and Blevins, half a mile away, which supplies water to 1300 acres. A second bank, 60,000/6600, conveys current to pumping plants No. 2 and No. 3, a total distance of six miles. The total load estimated for this outdoor substation, known as "Rice," is 1100 h.p.

The pumping season lasts from April 15th to September 15th, and during this period the load is practically constant. The maximum use of water is during the month of May, at which time the land is being flooded and drained at intervals until the plant growth permits the continuous flooding of the ground. The amount of water required per acre for rice is variable, depending on the nature of the soil and also on the methods of the grower. Under the conditions of good soil and careful irrigation, five feet per year may be used, but a use of seven acre feet is not abnormal, and even eighteen acre feet has been used on porous soils. It is obvious that the costs of pumping will largely determine what areas can profitably grow rice. For the average installation a power rate of one cent per kw.-hr. is being given.



General Map of Rice Fields of Northern California.

The average plant efficiency of irrigation plants may be assumed at 60 per cent on the higher class installations, falling as low as 40 per cent where cheap first cost alone is considered. For rice irrigation, where the monthly power cost may reach \$1500, the owner is justified in a critical examination of all plant details—pump efficiency, pipe losses, water velocity losses, etc. If his ditches pass through sections of porous soil, a concrete lining of the ditch may mean a big saving in operation. The permissible water velocity in canals is an item of importance, and one that varies



Unloading a Pump from a Barge on the Sacramento River.

largely with different soils. For the average "sediment adobe" soil of the rice belt, a ditch grade of three feet per mile will be satisfactory. Where sharper grades are necessary erosion will result unless protection is used.

For the average rice plantation, having its own pumping plants, ditches, etc., the total water cost per acre may be assumed as \$4.80, where the average water lift is not over 20 ft., and the water is obtained from a stream such as the Sacramento.

The problem of water supply for the rice industry will be the subject of much future discussion, and its solution will be probably found in large reservoir construction, as well as the construction of drainage canals which may reach the magnitude of water transportation canals, and these may convey the rice products to tide water.

ELECTRIC FURNACES AT SALT LAKE CITY.

The Utah Iron & Steel Company, Salt Lake City, Utah, is considering the installation of electric furnaces chiefly for converting the scrap material available in that district into soft steel which may be rolled in its mills at Middale, near Salt Lake City. It is considering also the possibility of utilizing local ores for the manufacture of ferrotungsten and ferrochrome. It may install a furnace of as large as 12 or 15 tons' capacity, and perhaps two of the furnaces. The interests controlling the Utah Iron & Steel Company, also own the American Foundry & Machine Company, Salt Lake City, which is expanding its foundry business, and in that connection is shortly to install a 3-ton Rennerfelt electric furnace. Low-cost electricity and an abundance of scrap material make the electric furnace an attractive proposition against local high cost of suitable coke and high-cost pig iron.

NAVIGABILITY OF COLUMBIA AND SNAKE RIVERS ABOVE CELILO.

BY MAJOR J. J. MORROW.*

I. General Description of Columbia River above Celilo and Snake River to Head of Grande Ronde Rapids. From the head of Celilo Falls to the mouth of the Snake River, a distance of one hundred twenty-four miles, the Columbia has a total fall of 184.5 ft. (or 0.93 ft. per mile). Of this fall 86 ft. is concentrated over sixteen rapids having an aggregate length of nineteen miles with slopes varying from three feet per mile at Hells Gate to 8.3 ft. per mile at Devils Bend. The highest velocity is probably about ten miles per hour. The principal obstructions to navigation in this stretch are the swift water at rapids and shoal water at several places, the principal shoal being Homly Rapids where there is a depth of four and one-half feet at low water. Considerable work of removing boulders in the channels has been done so that the river is now fairly free of channel obstructions and can be navigated throughout the year except when closed by ice. A description of the river and various projects is given in the Annual Report of the Chief of engineers, 1877, p. 1038 and 1850, p. 2293, respectively, and in House Documents No. 238, 51st Congress, 1st session, and No. 440, 59th Congress, 2d session.

From the mouth of the Snake River to Wenatchee, Washington, a distance of one hundred forty-seven miles, there is one hundred and thirty miles of river that is now navigable at all stages, except when closed by ice, for boats drawing three to four feet. The seventeen miles of obstructed waters include Priest Rapids (nine and one-half miles in length, fall sixty-eight feet), Cabinet and Rock Island Rapids, seventy, one hundred twenty and one hundred twenty-five miles respectively from the mouth of the Snake River, where, at a stage of from twelve to fifteen feet above low water, navigation is possible, though difficult and dangerous. From the foot of Priest Rapids to the mouth of Snake River the river is in good navigable condition except for some shoals of minor character.

A low water channel cannot be obtained by open channel methods and canalization will be required at Priest and Rock Island Rapids. Plans for the improvement of this stretch of river, including canalization, are outlined in House Document No. 693, 62d Congress, 2d session, in House Document No. 440, 59th Congress, 2d session, and House Document No. 186, 47th Congress, 1st session.

From Wenatchee to Bridgeport, a distance of about eighty miles, the river has sufficient depth for navigation and the only obstructions are swift water and rocks and reefs in the channels. The average low water slope is 2.2 ft. per mile. Considerable open river work has been done and there is said to be a controlling low water depth of five feet in this stretch of river, so that navigation can be continuous throughout the year except when the river is closed by ice.

A description of this stretch of river together with improvements proposed is given in House Document No. 440, 59th Congress, 2d session, in the Report of

*Corps of Engineers, U. S. A.

the Chief of Engineers for 1895, p. 3534, and in House Document 186, 47th Congress, 1st session.

From Bridgeport, Washington, to Kettle Falls, a distance of one hundred sixty-two miles, the river is navigable for steamers at certain stages. The channel between Bridgeport and Hell Gate, seventy-five miles, is comparatively safe, but to complete the work will require the removal of much more rock than has been removed by open river work. It is believed that a channel through the obstructions up to Grand Rapids fifty feet wide and velocities up to ten miles per hour can be obtained by open river work which would be available for about six months in the year, but such a channel would not be of great benefit to navigation. Kettle Falls has a drop of thirty-three feet at low water and Grand Rapids, six miles below, has a fall of twenty feet.

Several projects have been considered for this stretch of river and are outlined in Chief of Engineers reports for 1893 and 1912, and House Committee Document No. 16, 60th Congress, 2d session. To put the river from the mouth of the Snake to Kettle Falls, a distance of one hundred eighty miles, in shape for commercial navigation, will require canalization in many places.

On the Snake River from its mouth to Riparia, sixty-seven miles, there is an average slope of three feet per mile and navigation is difficult on account of numerous rapids with swift currents and shoal water, which before improvement were practically impassable at low water. Open river work has been in progress more or less since 1876 and there is now a controlling low water depth of thirty inches. Owing to the shallow depths on the bars and in the rapids, the navigation season for steamers does not begin until the river reaches a three-foot stage at Lewiston gage (usually about March 10) and continues through the summer freshets until about July 1. From July to the following March the river stage is too low for navigation except for occasional short periods due to rains which usually fall in November. During the winter months the river is often closed to navigation by ice. A history of this stretch of river is given in House Document No. 411, 55th Congress, 2d session, House Document No. 127, 56th Congress, 2d session, and Annual Reports of the Chief of Engineers for 1877-1880, 1903 and 1906.

From Riparia to Lewiston, a distance of seventy-three and one-half miles, the river has an average slope of 2.67 ft. per mile, is in fairly good shape, has a controlling low water depth of four feet. Navigation is carried on almost throughout the year except through the winter months, when there is ice. There is no through commerce on this stretch of river. The Oregon-Washington Railroad and Navigation Company operates two boats for the transfer of wheat across the river. The improvement of this stretch of river is discussed in House Document No. 127, 56th Congress, 2d session, and report of Chief of Engineers for 1877 and 1892 and 1901.

The river from Lewiston to Grande Ronde Rapids, a distance of thirty-one miles, has a slope of 3.6 ft. per mile and there are several rapids which are difficult to navigate. The principal obstructions are swift

water and boulders in the channels. Some open river work has been done and the river is in fair shape for commercial navigation to the foot of Wild Goose Rapids, about thirty-two miles above Lewiston. A description of the river, together with proposed improvement, is given in Report of Chief of Engineers, 1882, 1885, 1903 and 1905.

II. Navigation of the Columbia River above Celilo

Commercial navigation has existed on the Columbia and Snake rivers above Celilo, since 1858, when the steamer "Col. Wright" was built at Celilo and made a trip in June, 1860, up the Snake to Clearwater River and thirty-seven miles up the Clearwater. Lewiston, Idaho, was founded in 1860, and in 1863 the rush to the Salmon River mines in Idaho required greater transportation facilities than existed at that time and four additional steamers were built. By 1864 the fleet was increased to ten steamboats and the rates were as follows:

Portland to The Dalles..100 miles, freight	\$15.00	ton, fare	\$ 6.00
Portland to Umatilla...200 miles, freight	45.00	ton, fare	10.00
Portland to Lewiston...360 miles, freight	90.00	ton, fare	22.00

All of the above boats were 125 to 160 ft. long with beam from 24 to 31 ft. and 5 ft. depth of hold. In 1880-1881 two boats 200 ft. in length, 37 ft. beam and 6 and 7½ ft. depth were built at Celilo. All passengers and freight for The Dalles required a portorage at Cascades, and all for upper river points an additional portorage from The Dalles to Celilo. Navigation of the upper river declined rapidly from 1866 to 1870 and several steamers were taken over Celilo Falls to the lower river.

The boats mentioned all navigated the Columbia and Snake rivers. In 1867 the steamer John Gates made a trip up the Columbia River, passing over Priest and Cabinet Rapids and part way up Rock Island Rapids. Navigation of the Columbia River above the mouth of the Snake has been carried on intermittently on the various good stretches of river, but since the construction of the railroads there has been little navigation on the river above Priest Rapids. After completion of the Oregon-Washington Railroad & Navigation Company's line from Wallula to Portland in 1882, navigation of the upper Columbia and Snake rivers practically ceased. Navigation of the river above Celilo was not revived until 1906 when two small steamers were operated in connection with the Oregon State Portage Railroad which was constructed for the purpose of transporting freight from the foot of The Dalles Rapids to the head of Celilo Falls, during the construction of The Dalles-Celilo canal. In 1908 two large boats were built by the Open River Transportation Company to operate on the river above Celilo in connection with the Oregon State Portage Railroad.

The Open River Transportation Company suspended operations October 31, 1912, due to lack of patronage, and since that date there has been no through navigation on the Columbia and Snake rivers. The Oregon-Washington Railroad & Navigation Company operates two boats between Riparia and Lewiston, transferring wheat across the river, but does no other traffic. A gasoline boat operates on the Snake above Lewiston to Pittsburg Landing, seventy-five miles above Lewiston, during favorable stages.

It is believed that the opening of The Dalles-Celilo Canal will revive the navigation of the river, as it will permit continuous navigation from Portland to Wild Goose Rapids, thirty-two miles above Lewiston on the Snake River, and to the foot of Priest Rapids on the Columbia River.

The Columbia River above Priest Rapids will not be available for through navigation until Priest Rapids and some others are surmounted by canalization, so the only source of limestone available will be that existing on the Snake River at the head of Grande Ronde Rapids, about thirty-one miles above Lewiston.

The navigation season on the Snake is controlled by the stretch of the river between its mouth and Riparia where, on account of shoal water and swift currents, the navigation season is limited to river stages above three feet on the Lewiston gage and will not exceed one hundred days annually, say from March 15 to July 1. To handle 100,000 tons of limestone annually would then require an average daily movement of 1000 tons. Barge navigation on the upper Columbia and Snake rivers has not been tried as yet, but it is possible that a powerful steamer could handle two 500-ton barges of four foot draft on the river above Celilo with a river stage of more than three feet at Lewiston, and make a round trip in five or six days. The trip upstream with empty barges would probably be more difficult than the downstream trip with loaded barges. To handle 1000 tons daily for 100 days would require a fleet of say eight steamers and sixteen barges and the cost of transportation would depend upon the method of handling the work. A transportation company might make a contract for the work or the power plant have its own equipment. The cost of operating a river steamer of the type used on the upper Columbia River should not exceed \$100 per day and this would, without overhead expenses, repairs, etc., make the cost of transportation 60c per ton where one steamer handles 1000 tons every six days. It is possible that 500 ton barges cannot be handled on the Snake River, so that the cost of transportation would be greatly increased if the size of the barges had to be cut down to say 300 tons, as one steamer would then handle only 600 tons in six days at a cost of \$1 per ton for transportation, and the maximum annual tonnage would be only 60,000 tons unless the number of steamers and barges were practically doubled.

An approximate estimate of the annual cost of a plant to handle 100,000 tons, based on 500 ton barges would be as follows:

8 steamers at \$60,000 each.....	\$480,000
16 barges at \$5,000 each.....	80,000
	<u>\$560,000</u>

Operating and Other Expenses with Plant Owned by the Power Company.

	Annual	Three Months.
Depreciation, 10 per cent.....	\$56,000	\$14,000
Repairs, 10 per cent.....	56,000	say 20,000
Interest, 6 per cent.....	33,600	8,400
Overhead expense, say.....	20,000	5,000
Operating expenses, three months.....	72,000	72,000
Care of plant for nine months.....	15,000	
	<u>\$252,600</u>	<u>\$119,000</u>

The final cost would therefore be approximately \$2.50 per ton for transportation if the plant were owned and operated solely for transportation from quarries at

Grande Ronde on the Snake River. Of course it would be possible to use the plant on the Columbia River between Portland and Priest Rapids for commercial freight during the nine months when navigation on the Snake is closed and the cost for transportation would be cut down to about \$1.20 per ton. The last named figure would probably represent the minimum rate at which a transportation company could afford to do the work and this only if organized on a large scale as outlined herein. It also is based upon the existence of conditions favorable for the use of a plant outside the short working season, which will probably not be true for some time to come.

It is not believed that any better figure could be arrived at by investigating the probable cost of operating looking toward constructing cheap barges at Grande Ronde and dismantling them at The Dalles. The supply of timber near the quarry is not sufficiently accessible to justify even a study along these lines.

CAUTION IN THE USE OF THE ELECTRIC IRON.

For the second time within two weeks the San Francisco papers have contained items wherein an electric iron has been carelessly left on and consequently burned through the ironing board, table, floor and ceiling, making its appearance in the room below.

It is a known fact that the electric iron is one of the greatest fire hazards that are to be found among the many electrical appliances of the modern householder. The public should as a consequence bear the fact in mind and use this wonderful little time saver and modern convenience with the proper precaution of turning the switch when its use is over.

OPERATING COSTS FOR ELECTRIC HOUSEHOLD APPLIANCES.

Here are some costs per hour to operate electric household appliances on a 7 cent per kw. rate, as reported by the Electrical Review:

Appliance.	Cents.
Electric washer	1.1
Vacuum cleaner	0.9
Iron	3.9
Toaster	3.2
Fan	0.4
Heating pad	0.4
Milk-bottle warmer	3.5
Perculator	2.7
Sewing machine motor	0.4
Grill	4.2
Chafing dish	3.5

With these figures as a basis the average cost of washing, ironing, sweeping, etc., for a family of six persons amounts to the following:

Operation.	Cents
Washing, once a week, 2 hours' use of current.....	2.8
Ironing, 4 hours' use of current.....	15.6
Sweeping, thrice weekly, 2 hours' use of current.....	1.8
Sewing, 3 hours a week	1.2
Total	<u>21.4</u>

The cost of cooking for a family of six is:

	Cents
Broiled chops, saute potatoes (grill).....	1.05
(Both cooked at same time, 15 minutes).	
Coffee (percolator), 15 minutes	0.6
Toast (electric toaster), 10 minutes.....	0.6
Total	<u>2.15</u>

DISCUSSION OF ALL THE VARIOUS FORMULAS FOR COMPUTING THE SKIN EFFECT.

BY CLEM A. COPELAND.

(In our issues of July 29th and August 5th, the author set forth certain formulas for computing the skin effect of solid and stranded cables. This discussion was followed by citing definite numerical examples. In this article attention is called to the fact that other formulas for computing the "skin effect" appear in standard reference books some of which should be used only under certain conditions while others are erroneous and should be avoided. Attention is also emphatically called to the fact that the "proximity effect" of cables is usually neglected in current formulas treating the subject while it is shown that this effect not only enters but often becomes the most important factor in the discussion.—The Editor.)

By investigating the relation between the argument \mathcal{K} , and K_R in Table I it will be found that for low values of K_R the (\mathcal{K} , K_R) curve is parabolic in trend, whilst for high value it becomes practically a straight line, i.e., asymptotic. There are consequently, many formulae which fit the two kinds of curves involved, more or less closely and which may be used if judiciously applied within specified limits.

It is recommended however that all other formulae and tables be abandoned for the Kelvin treatment of the problem so satisfactorily expounded by Mr. A. E. Kennelly, inasmuch as the U. S. Bureau of Standards has given us a table of splendid merit, and the Kelvin treatment exhibits other useful and interesting phenomena in this connection. Furthermore, Kelvin's formulae as exhibited in equation (3) and Table I have been experimentally verified.

Moreover, not only do we obtain the value of K_R and K_L readily for any values of r_1 , f and μ from zero to practical infinity but the mathematical derivation gives us a perfect mental picture of what actually goes on inside of the conductor.

In Fig. 1, as an instance, the cup shaped curve shows the maximum values of the current densities at various distances from the center of the conductor of Problem I, while to the right appear sinusoidal curves of the current at radii .475 in., .95 in., 1.425 in., 1.9 in. and 2.3751 in., lagging behind the current at the center by the angles there shown. One may calculate that at the time when the total current in the conductor is zero there are still currents flowing in opposite directions in different parts of the conductor. When the current at the surface is a maximum in one direction the current is almost zero at a radius of 1.9 in. and flowing in the opposite direction at a radius of 1.425 in.

Other interesting investigations may be made in great number.

As this is a critical discussion intended to point out the blind trails as well as the well travelled highways, the following well known and often misapplied methods may prove of value.

Probably the most familiar formula in this connection fitting the lower part of the (\mathcal{K} , K_R) curve is the infinite series,

$$K_R = 1 + \frac{1}{12} \left(\frac{2\pi f \mu l}{R_{dc}} \right)^2 - \frac{1}{180} \left(\frac{2\pi f \mu l}{R_{dc}} \right)^4 + \dots \quad (5)$$

wherein l is the length of the wires in centimeters.

This formula will be found on pages 67 and 334 of the "Standard Handbook for Electrical Engineers," acknowledgment being made to Gerard's "Lecons sur l'Electricite," Vol. 1, Page 236. This formula is also derived by Andrew Gray in "Absolute Measurements in Electricity and Magnetism," Vol. 2, part 1, pages 325 to 329, together with the allied and less familiar formula

$$K_L = \frac{\mu l}{2} - \frac{1}{48} \left(\frac{2\pi f \mu l}{R_{dc}} \right)^2 + \frac{13}{8640} \left(\frac{2\pi f \mu l}{R_{dc}} \right)^4 - \dots \quad (6)$$

Formula (6) was also copied in an erroneous form on page 147 of our old familiar "Alternating Currents and Alternating Current Machinery" by D. C. and J. P. Jackson, wherein f should be replaced by $2\pi f$.

The formulae (5) and (6) are given in many different equivalent forms, the most common being their conversion to every day units from their above form in C. G. S. units. Thus

for l substitute 30.48 l ;

for R_{dc} substitute $10^9 R_{dc}$; then

for $10^9 R_{dc}$ substitute $\mu l / A_{om}$ and reduce thus

$$K_R = 1 + \frac{3.0}{10^{15}} \left(\frac{\mu f A_{om}}{\rho_0} \right)^2 - \frac{7.5}{10^{30}} \left(\frac{\mu f A_{om}}{\rho_0} \right)^4 + \dots \quad (7)$$

in which A_{om} is the area in circular mils and ρ_0 is the resistance of a mil-foot of the conductor.

From (7) various curves and tables have been made out giving the values of K_R for copper, aluminum and iron (erroneously) for various values of $f A_{om}$.

This series is obtained by dividing one series by another, together with the assumption that $\pi r_1^2 / \rho$ is small, (ρ being 1714.1 for copper at 20° C. while r_1 is in cms.) it has therefore been pointed out that (7) should not be used when $f A_{om} > 10^8$ corresponding to $K_R > 1.222$.

Thus a 1,666,700 cir mil copper rod at 60 cycles or a No. 0. B. & S. Gauge wire at about 945 cycles would approximately define the upper limit of the formula's accuracy.

Using another term in the series would result in raising the limit to $f A_{om} = 1.8 \times 10^8$, corresponding to a 3,000,000 cir mil rod at 60 cycles or a 30,000 cir mil wire at 6000 cycles.

The "Standard Handbook" states (p. 280) that above $K_R = 1.5$, formula (7) should be replaced by the approximate asymptotic formula:

$$K_R = \sqrt{\frac{1.592 \mu f A}{10^8 \rho}} + .26 \dots \dots \dots \quad (8)$$

This expression pretty accurately fits the upper or straight line part of Kelvin's curve.

Another formula cited by Steinmetz estimates the equivalent depth of current in flat conductors as

$$S = 5030 \sqrt{\frac{\mu f}{10^9 \rho}}$$

This of course is only applicable to very large cylindrical conductors, in which case

$$K_R = \frac{r_1^2}{r_1^2 - (r_1 - S)^2}$$

On page 148 of "Altering Currents and Alternating Current Machinery," by D. C. and J. P. Jackson (1896), one finds the following statement:

" * * * the frequency or the diameter of the wire may be so great that no current at all will flow at the center of the conductor, while if the frequency is very great the current will all remain at the exact outer surface or skin of the wire."

This is evidently true at only one particular instant of time or for one particular value of \times at all times.

In nearly all discussions in text books, hand books and various papers, it is worthy of note that the "proximity effect" is not mentioned.

Curiously enough the "proximity effect" is the most important part of the whole discussion because in large conductors where skin effect becomes prominent, engineering conditions usually dictate that they be near together, as in "duplex" and "triplex" or three-phase cables or in busses and leads to electrolytic sinks and electric furnaces.

Various Other Forms of Conductors.

Mr. Kenelley has presented a voluminous amount of experimental data on the skin effect in rectangular and tubular conductors in various relative positions with respect to each other, while the U. S. Bureau of Standards has given us complete data on the effect in bimetallic wires. These two papers together with the data collected and enlarged upon used in connection with handbooks are considered quite satisfactorily complete for present uses.

MAKING AMERICANS OF FOREIGN-BORN WORKMEN.

The Chamber of Mines and Oil, a live organization recently established in Los Angeles to promote the interests of production of crude petroleum in the southwest, has taken up the subject of making Americans of foreign-born workmen. The subject is a broad one and aside from its patriotic aspects vitally interests all large employers of men.

The secretary of the National Amalgamation Committee, Mr. F. A. Kellor, states that during the past year there has been for obvious reasons a distinctly increased interest in American citizenship as affecting foreign-born workmen. The Federal Bureau of Education, the Bureau of Naturalization, the National Chamber of Commerce, through its recently appointed Immigration Committee, and various local chambers of commerce, and other agencies in cities throughout the country have definitely assumed the responsibility of promoting the use of the English language and American citizenship among the foreign-born workmen and women throughout their cities. Usually this has been done as a matter of direct co-operation with the public night school system.

The co-operation of the employer has been, in all these efforts to promote Americanization on a community scope, a fundamental necessity. In Detroit, Syracuse, Rochester, Youngstown, Wilmington, Delaware, Minneapolis, and elsewhere it has been the organized interest of the chambers of commerce in the work that has given solidity to the movement.

STANDARDS FOR ELECTRIC SERVICE.

BY U. S. BUREAU OF STANDARDS.

The U. S. Bureau of Standards in its Circular No. 56 has just issued an important code of standards for electric service. Copies of this publication may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at forty-five cents per copy. The circular in all contains 262 pages of reading matter and will prove of inestimable value to utility companies, regulating commissions and others interested in the standardization of electric service.

The regulation by state commissions of public service utilities other than common carriers is becoming more widespread yearly. Less than 10 years have elapsed since the first state commissions were created, yet regulation has already been established by law in greater or less degree in 30 or more states. It is now generally recognized that the supply of electric service is a natural monopoly, and should therefore be regulated by the state or by the municipality.

The intelligent and fair regulation of any utility requires a thorough knowledge of the elements that together constitute good service. It also requires a knowledge of what it is possible to supply at a given cost or what the increased cost will be if the service is improved in any particular respect. The Bureau has studied some of these questions with respect to gas service, and its publication, Standards for Gas Service, is now in its third edition, there having been a very great demand for it from gas engineers and other representatives of the gas industry and also from public service commissions and city officials. The time now seems ripe for the publication of a similar study and discussion of the subject of electric service.

The supply of electric energy from central stations for electric light and power had its first beginnings a little over 35 years ago. Marvelous advances have been made since then in the generation, distribution, and utilization of electrical energy, but the question of standards of service has been to a large extent ignored, due partly to the rapid growth and development of the industry and partly to the absence of any suitable agency for making a thorough study of the subject. The National Electric Light Association and the Association of Edison Illuminating Companies have done excellent work for years on the subject of meter specifications, but have not attempted to set standards of service.

A number of state commissions have adopted rules and recommendations for electric service regulations which, however, vary considerably in their requirements. This makes it desirable to collect and compare the provisions of such state rules and to propose such standards as may be applicable generally.

A number of cities in states not having regulating commissions have established municipal commissions and inspection bureaus. The Bureau of Standards has co-operated with certain of these, as well as with state commissions, and has been to a certain extent a clearing house of information with reference to the important questions of standards and accepted good practice.

This circular attempts, therefore, to present a survey of the general field of state and municipal regulations in so far as standards of electric service are concerned; and presents suggested rules and regulations which may be adopted as proposed or which may form the basis for rules and ordinances to be adopted by states and cities.

Criticisms and suggestions on this circular are desired from all interested persons, especially from commissioners and engineers of commissions, public utility operators and engineers, committees of technical societies, municipal commissions, municipalities, and operating companies. The bureau is ready to assist to the fullest extent in the establishment of standards and the promotion of a good understanding between regulatory bodies, operators, and customers.

In order that the readers of the Journal may get a comprehensive idea of the scope of this important work we append herewith a full detailed list of the subject matter treated:

Introduction.

1. The Adequacy and Safety of Electric Service.

A. Electric service standards.

B. Factors influencing adequacy of service.

1. Central station operation.

- (a) Adequate power and generating capacity; (b) Regulation of generating apparatus; (c) Switchboard instruments; (d) Station records.

2. Distribution systems.

- (a) Voltage regulation of feeders and mains; (b) Transformer and secondary main losses; (c) Efficiency of distribution.

3. Meters.

- (a) Accuracy requirements for watthour meters; (b) Installation and testing of meters.

4. Customers' utilization devices.

- (a) Incandescent lamps, Voltage and frequency effects. Supervision of lighting service; (b) Motors; (c) Heating and other devices.

C. Safety of electric service.

- 1. General statement; 2, Grounding low potential circuits; 3, Commission jurisdiction and procedure with reference to accidents.

II. Meters and Instruments.

1. Facilities for meter testing.

2. The approval of types of meters.

- 3. Suggested specifications governing approval tests of types of electricity meters by State commissions; general provisions for the approval of types of watthour meters by the commission; Specifications for design and construction; Preliminary preparation of meters for tests; Conditions governing the approval and rejection of types; Specifications for the testing of direct current watthour meters; Specifications for the testing of single-phase induction watthour meters; Specifications for the testing of polyphase watthour meters.

b. Amperehour meters.

5. Demand meters.

III. Standardizing Laboratories of State Public Service Commissions.

Description of commission laboratories.

IV. Rules and Regulations for Electric Service as Adopted by State Commissions.

Abstract of titles of state rules; Accidents; Allowable errors of meters; Application of rules—Definitions; Commission inspections, tests and laboratory; Complaints; Creeping meters; Deposits to insure payment of bills; Discontinuing service; Extension of lines; File of schedules of rate, rules and regulations; Fraudulent use; Frequency variations; Grounding of secondaries; Information for customers as to service; Inspection of distribution systems and apparatus; Inspection of lamps and lamp renewals; Interruptions of service; Maintenance and construction; Meter installation tests; Meter location; Meter readings for customers; Meter readings on bills; Meter rentals; Meter testing equipment; Meter test methods and place; Meter test records; Periodic test of meters; Pole identification and inspection; Referee or commission tests—fees; Refunds and bill adjustments; Replacement of meters; Reports and records; Request tests by customer; Station records; Voltage surveys; Voltage variations.

V. Suggested Rules for the Regulation of Electric Service by State Commissions.

VI. The Regulation of Electric Service by City Ordinance.

List of cities.

Charleston, C. S.; Chicago, Ill.; Cincinnati, Ohio; Grand Rapids, Mich.; Harrisburg, Pa.; Kansas City, Mo.; Los Angeles, Cal.; Louisville, Ky., Memphis, Tenn.; Minneapolis, Minn.; Norfolk, Va.; Providence, R. I.; Sandusky, Ohio; San Francisco, Cal.; Sioux City, Iowa; St. Louis, Mo.; Topeka, Kans.

VII. Suggested Ordinances for the Regulation of Electric Service in Towns and Cities.

- 1. For towns and small cities; 2, For cities generally; 3, For larger cities.

Appendixes.

Appendix 1.

- 1. Summary of state laws now enacted providing for the regulation of electric service.

List of statutes covering subject of electric service.

- 2. Summary of laws relating to accidents and safety provisions under the jurisdiction of public service commissions.

Appendix 2.

Tables.

- 1. Maximum watthour meter errors allowed by commission regulations; 2, Maximum watthour meter errors allowed by city ordinances; 3, Maximum watthour meter errors allowed by statute; 4, Periodic meter tests, N. Y. P. S. C., first district; 5, Periodic meter tests, N. Y. P. S. C., second district; 6, Complaint meter tests, N. Y. P. S. C., first district; 7, Meter accuracy improvement; 8, Meter accuracy by types; 9, Meter sizes on a typical system; 10, Voltage regulation requirements; 11, Central station statistics; 12, Municipal central station statistics.

Appendix 3.

Rules and regulations of Maryland Public Service Commission, February 1, 1916.

Appendix 4.

Chicago ordinance, July 15, 1915.

Appendix 5.

California Railroad Commission, Case 683, Dec. 1, 1915.

Appendix 6.

Selected bibliography.

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FINAL REPORT ON THE COLUMBIA RIVER POWER PROJECT.

BY BOARD OF REVIEW.*

Honorable Franklin K. Lane,

Secretary of the Interior, Washington, D. C.

Sir: Your Board of Review appointed under instructions received through the Director of the Reclamation Service bearing date of October 28, 1914, was directed to consider and to review the report on the project for the development of power on the Columbia River at The Dalles, Oregon, prepared under the direction of and by certain engineers of the U. S. Reclamation Service and the state of Oregon, pursuant to an agreement between the Department of the Interior and the state of Oregon dated December 12, 1913.

These instructions indicated the scope of the desired review as covered by the terms of the contract executed between the U. S. Government, represented by the Reclamation Service, and the state of Oregon, and relating to the investigation of this problem.

From this contract we quote as follows:

"That surveys and investigations be made in that portion of the States of Oregon and Washington leading to the preparation of detailed plans, specifications and estimates of cost for the maximum economical development of waterpower in the Columbia River, near The Dalles, at what is known as Five Mile Rapids."

In accordance with these general instructions, your Board assembled at The Dalles, Oregon, on November 19, 1914, and spent most of the day in an examination of the physical features at and near the dam and power sites. The Board then returned to Portland, and during the following days considered the above mentioned report, together with the maps, drawings and other data relating to the project and on file at the office of the Reclamation Service.

The project in general terms involves the control of the entire flow of the Columbia River at a point near The Dalles, Oregon, the construction of a power canal, and the erection of a power house at a point about one and one-half miles below the point of control. The quantity of water involved will vary between about 30,000 second feet minimum and some 1,170,000 second feet maximum. The head for plant operation will vary from a minimum of about 45 ft. under usual flood condition to 105 ft. under low water flow. The power which can be developed continuously twenty-four hours per day and 365 days in the year will aggregate about 480,000 electrical horsepower, with the possibility of the development of additional large blocks of power for a part of the year, all as shown in detail in the main report.

In considering a project of this character we may advantageously subdivide the question under three heads:

- (1) Engineering feasibility;
- (2) Cost, assuming engineering feasibility;
- (3) Commercial feasibility.

*Secretary of the Interior Franklin K. Lane appointed a board to consider the foregoing investigations of the Columbia River Power project and to report thereon. The personnel of the board was as follows: Brigadier-General W. L. Marshall, Ex-Chief of Engineers, U. S. Army and Consulting Engineer to the Secretary of the Interior, chairman; other members were: Ralph Modjeski, Consulting Engineer, Chicago, Illinois, and Portland, Oregon; W. F. Durand, Professor of Mechanical Engineering, Stanford University; and D. C. Henny, Acting Chief Engineer, U. S. Reclamation Service. The report was filed with the Secretary of the Interior on Nov. 21, 1914.

Engineering Feasibility.

Examination of the proposed site, together with the detailed studies presented in the main report, show that the principal technical problems center around the following features:

- (a) The closure of the present channel;
- (b) The provision of suitable control gates for flood conditions;
- (c) The main power canal;
- (d) The power house and generating machinery.

Of these, the last two present no features of unusual difficulty. The character of the work is plain and straightforward, and permits of direct comparison with a large amount of work on other projects of an entirely similar character. Neither of these features seems likely to present any problem of a difficult or controlling character in relation to the project as a whole.

With regard to items (a) and (b), the problems are somewhat beyond direct precedent, both in magnitude and character. The main report presents in detail a discussion of these problems, together with suggestions of several alternative methods through which the work may be carried out, and with the suggestion of the need of still further study before attempting to adopt a final and definite solution.

In our judgment the engineering feasibility of the project as a whole will be determined by the question of these two items, which must be viewed as the controlling engineering problems. We are, however, of the opinion that the present resources of engineering art offer every reasonable assurance of a possible and practicable solution. We believe further that some one or another of the various methods suggested in the main report might reasonably be expected to furnish a possible solution. We are not prepared, however, to endorse any one of these methods as presumably the best possible, nor do we believe that any such final choice of method should be made in advance of further detailed study and investigation. It should be noted that this opinion is in entire accord with the conclusion of the main report.

Cost.

In the brief time at our disposal we have not been able to make any detailed review of the estimates of cost. We have, however, noted carefully the various unit costs employed, and have given special consideration to the resulting cost of certain of the larger items.

We are prepared to endorse as reasonable the general schedule of costs thus resulting from these various unit prices, and, while in making a detailed estimate ourselves we should be inclined to modify certain items, the influence on the total would be relatively inconsiderable.

Broadly speaking, we believe that the project as an engineering construction could be completed to the point contemplated in the outline designs submitted in the main report for a sum which may, including interest at 6 per cent during construction, approximate \$55,000,000.

Commercial Possibility.

The intelligent study of this part of the subject requires consideration of the following:

(1) The present demand for electrical power in the territory which can be considered as tributary to this project and the probable rate of growth of such demand under normal conditions;

(2) The extent to which the demand for electrical power may permit of building up in large blocks by the establishment of special industries;

(3) The most economical sources of power to meet advancing demand in this territory, in accordance with any assumed probable or possible rate of growth, and having in view a wise public policy with reference to the conservation and development of our natural resources.

(4) The economic results to be anticipated, assuming the proposed plant to be built as contemplated, and with such an estimated rate of growth of paying load as might be considered probable.

The main report presents a large body of valuable matter bearing on topics (1) and (2), the present and future prospects regarding the market for power. With the general conclusions reached therein we are in entire accord. We do not consider that the growth of the power demand under normal conditions would be sufficient to absorb the output of the proposed plant until after the lapse of an uncertain but considerable period of years. We consider, furthermore, having in view the present state of the art, with regard to the electro-metallurgical and the electro-chemical industries, as well as the conditions with regard to the location of this plant in relation to raw materials and immediate market, that there is no present prospect of the building up of a demand for power in this territory in blocks which might represent any large fraction of the total output.

Again, while we have had no opportunity of examining the point in detail, we are prepared to state, on the basis of facts well known in the history of the development of water power in this general territory, that for some years to come the normal growth in power demand can be met most economically by additions to existing plants now only partially developed, or by the development of small projects more nearly proportional to the power which is likely to be required in succeeding years.

Reference to the technical problems involved, as shown in the main report, indicates that it is not possible to make the necessary hydraulic development by stages, and the schedule of costs will show that the necessary capital investment before any power whatever can be produced in the proposed plant will approximate from \$35,000,000 to \$40,000,000. In these circumstances it follows that unless a paying load approximating close to the full capacity of the plant is ready immediately upon completion, the annual fixed charges will exceed the income, and a deficit will begin to accumulate, which must be met by further borrowing; thus constituting an addition to the capital account until such time as the plant may become self-supporting.

By way of illustration we have assumed a period of ten years during which at a uniform rate of growth such total load might be acquired.

Computation shows that on a three per cent interest basis the accumulation of deficit during these years of development of business may cause the aggregate investment at the end of the tenth year to reach \$61,000,000. On a four per cent interest basis this aggregate may be \$63,000,000, while for six per cent securities discounted ten per cent and assuming deficits to have been met by additional bond issues, the face value of the bonded indebtedness at that time may reach \$78,000,000.

Such ultimate growth of the capital investment will cause corresponding increases in the prices at which power must be sold to the consumer as compared with prices based on capital representing the cost of the physical property alone.

Any project of the character and magnitude of that under present consideration should be provided at the start with a load closely approaching its ultimate output, otherwise the losses during the early years of development of business will entail large additions to the capital account and corresponding increase in the prices at which power must be sold.

It appears that there is no present commercial demand which at possible prices of power as shown in the main report, Appendix I, could justify the immediate development of this project, nor can we see any prospect of any such demand in the immediate future, and we therefore conclude that the development of the project can not be economically justified at the present time.

The commercial feasibility of this project must be judged in relation to the comparative cost of other large undeveloped projects in the West. No broad comparison can at present be made. It is self evident, however, that, broadly speaking, the construction of this project should not precede but should follow the development of cheaper power. The cost figures in the main report render it probable, however, that at some time in the future a definite commercial demand for this project may exist, and its development under such conditions will most notably add to the industrial wealth of the adjacent territory.

In closing we desire to express our high appreciation of the large amount of work which the authors of the main report with their collaborators and assistants have accomplished in a limited time, and of the thorough and careful study which these various problems have received at their hands.

Respectfully,

W. L. MARSHALL,

Consulting Engineer to the Secretary of the Interior.

RALPH MOJESKI,

Consulting Engineer.

D. C. HENNY,

Acting Chief Engineer, U. S. Reclamation Service.

W. F. DURAND,

Prof. of Mechanical Engineering, Stanford University.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

From Southern California comes the news that "cooking by wire" is gaining in popularity. Two transmission line short circuits were recently caused by birds dropping snakes across the line. Needless to say the snakes were beautifully roasted.

* * *

In the last eighteen months gold has been imported in the United States to the extent of \$688,877,000. According to our population of 100,000,000 we are all about seven dollars richer.

* * *

And now it is reported that some enterprising American dentist, armed with the latest electrical dental appliances, has gone to the "new Russia" to open an office, calling himself "Painlessky Pulliyotusky."

* * *

We trust that he will not become so fascinated with the native Vodka that his American friends later may be tempted to call him "Casky-whisky."

* * *

More than ten thousand miles of macadam roads have been ordered built in Afghanistan since the ruler of that country became the owner of an automobile. He must be some speeder.

* * *

In America we like to travel by automobile also. In 1905 there were only 48,000 motor-cars, while in 1915 there were 2,445,664.

* * *

A committee of thirty appointed to study the question of storage of flood waters on the Kings River in the San Joaquin Valley reports that abundant storage capacity is available for the conservation of more than six hundred thousand acre feet at a cost of about ten dollars per acre foot, and that this would furnish ample irrigation for more than a million acres of land.

* * *

Even South Africa hopes to put itself on a commercial basis in certain electrochemical industries. Agriculture and mining now require annually about \$10,000,000 worth of chemicals, all of which are imported in form of fertilizers, cyanide and nitrates. Cheap electricity, abundant coal, limestone, and the necessary labor—essential elements for producing these compounds—all exist in South Africa.

* * *

Unusual commencement exercises were held recently at the Kansas penitentiary at Lansing. Thirty-one inmates of the big prison became graduates of the Kansas Agricultural College and received the same diplomas from the college that the boys and girls had received at Manhattan a week previous.

* * *

Ceramic engineering, including the science and practice of porcelain factories making electrical insulating materials, is to be taught in a new department at the University of Illinois, Urbana.

Heating and cooking rates of five cents per kilowatt hour, or less, in 3250 communities, are on file in the office of the Society for Electrical Development. About 70 per cent are 4 cents and under, and 30 per cent are below 3 cents.

* * *

American enterprise suffers in Buenos Aires due to the existence of lower freight rates to European countries, although the distance to New York is shorter. Recently an American firm lost a \$3,000,000 contract due to this discrimination in rates, enabling European competitors to underbid.

* * *

A corporation called the Sociedad Recaudadora de Impuestos was formed in Peru in 1895 with a capital of \$973,300. Its purpose is to assist the government in the collection of taxes.

* * *

The traditional Kentucky Colonel may have value but listen—the export trade in palm kernels for 1913 from the British possessions was valued at \$25,000,000.

* * *

The output of dynamos, including parts and supplies in 1914 was valued at \$23,333,437, an increase of 34.8 per cent over the corresponding value five years previously.

* * *

In the recent disastrous floods in North Carolina the physical connections of long distance high voltage transmission lines of several independent power corporations in Alabama, Tennessee, North Carolina and Georgia saved the day so far as electric service was concerned. It's an old saying but a true one: "Hang together or you may hang separately."

* * *

As a safety precaution the Kansas Railway carries on each of its cars a tail lamp with a 10 in. glass lens. When the trolley energy supply is interrupted the tail lamp and markers are automatically lighted from a storage battery.

* * *

President Wilson has signed a bill appropriating \$75,000,000 for federal-aid highways. It has been estimated that during the next five years \$1,500,000,000 will be expended by state, county and federal government.

* * *

It is said that a very small quantity of ether inserted in the cylinders of a gasoline engine will enable the operator to start in cold weather on a quarter turn. "Ether" do this or use more arm-power. This is a bum joke and apologies are hereby made.

* * *

Electrical dealers should be careful of punctuation for display signs in their windows. Here is one from an apartment house: "Please knock bell out of order."

JOURNAL OF ELECTRICITY

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During recent years the electric pumping load for large Western power companies has exceeded the fondest expectations of former days. It is interesting to see how widely extended the application of different classifications of pumping load have now become. The latest diversion of electric power to this field of activity is to be found in the rice fields of California.

Five years ago the agricultural possibility of rice growing in California was an unknown quantity. Two years ago it became recognized as a possibility while today that rice can be grown to economic advantage in California is an established fact.

Last year for instance one company in California, putting under cultivation 3200 acres, produced 140,000 sacks of rice. These hundred pound sacks each whole-saled for \$1.80. So it is at once seen to what prosperous totals this new agricultural possibility lends itself. This particular crop for instance netted the owning company about forty dollars per acre.

From the power salesmanship point of view, this new agricultural pursuit is creating a most desirable load. Rice can be most economically grown in California by using large acreages. The pumping season for irrigation lasts from April 15th to September 15th and during this period the load is practically constant, consequently low power rates are commercially possible. Notwithstanding the fact that a one cent per kw.-hr. rate is often granted for this class of pumping, nevertheless, the power bill for one consumer's rice fields detailed on another page in this issue total some fifteen hundred dollars per month.

It is not known as yet what acreage may eventually prove possible for rice production in the San Joaquin Valley and other valleys of the West but it is known that in the Sacramento Valley alone over one hundred thousand acres of first class rice lands exist. As a consequence of this bright outlook for rice production in the West, the power companies are again to be congratulated upon the opening up of a new and profitable classification of electric pumping service.

One of the main points of difference between the navigable stream power development bills which have passed the Senate and the House is the requirement as to the construction of locks and other aids to navigation. The Senate bill requires that these be built in accordance with the specification of the Secretary of War at the time the dam is built. The House bill calls for such locks as the Secretary or Congress may "at any time" deem to be necessary, thus introducing an indefinite risk which capital will not assume. This difference is a serious obstacle to any compromise legislation that the joint conference committee may reach before the present session closes.

The great fault with the existing laws regulating hydroelectric development is the uncertainty as to terms. A liberal interpretation might make develop-

ment possible where the likelihood of the contrary deters investment. So in this one instance, at least, the understanding should be specific so that the facts may be known at the start.

This lock construction requirement in both bills, however, is based on a misunderstanding, a relic of the time when navigation was the highest use to which water could be applied. That day and age is passed. Today, water is more useful for irrigation, domestic supply and power development than for navigation. Even where streams are navigable most of the traffic is handled otherwise. Except as a big stick for enforcing lower rates comparatively little use is made of the navigable streams of the United States, and even this limited use is on the decrease.

More than eight hundred million dollars has been appropriated by Congress during the past fifty years for improving the rivers of the country. This is hardly a drop in the bucket as compared to what is necessary to make the fifty thousand miles of navigable streams fit for commerce. As few of these river improvements are self-supporting any plan whereby private capital will help carry the burden is most appealing.

If river navigation were still the chief economic need of the country there would be no doubt as to the wisdom of such a plan. But in the West, today, irrigation and power development are paramount to navigation. Many more people will be benefitted by watering the semi-arid areas than will be helped by river transportation. Water withdrawn for irrigation is naturally not available for navigation, but in view of the principle of "the greatest good to the greatest number," who can question the wisdom of such a diversion?

It seems the height of economic folly to hamper irrigation and power development in order that unneeded and unused navigation facilities be provided. Yet this is the basis whereon the War Department exercises control over many streams suitable for power purposes.

In the stone age waterways were needed. In this electric age they are not. The laws governing water usage have failed to keep up with modern modes of transportation. Let burdensome requirements be eliminated from irrigation and power projects in order that the march of progress not be halted.

Another instance is chronicled in this issue of the Journal wherein a vast power development is thought inadvisable for the present due to the prohibitive interest charges that would ensue upon unused equipment in the first years of power applications.

It is estimated that the great power project at The Dalles on the Columbia River may be made to generate 365 days in the year, a total of 480,000 electrical horsepower at a cost of \$55,000,000. The figure in itself would present a remarkably attractive proposition were the market fully developed for its utilization. Since, however, the market is not developed

it is estimated that before the sales for this enormous power could be reasonably depended upon the interest charges would run the cost of the project up to some \$73,000,000, thus making it prohibitive.

An emphatic moral is to be drawn from this report on the Columbia River Power Project. Too often have ultra conservationists scandalized the costs of power and income to be derived from its sale when certain private companies are undertaking to open up a new field of hydroelectric development without taking this important factor into account. In other words, too often does the public, unfamiliar with the long years necessary in nurturing a power development into a paying proposition, overlook the fact that years and years of careful studying of market conditions and encouraging of new industrial activities must ensue before the power company as a rule can come into its own and reap the harvest to be acquired by operating under a reasonably high load factor.

Let the public, then, and its regulating commissions, take from this lesson on the Columbia a more lenient attitude toward the utility companies and the risks involved in development of hydroelectric power and its markets.

Social insurance in its broader aspects attempts to establish on an equitable basis a system of insurance operative not only in case of death but in the event of the sickness, invalidity, old age or even unemployment of the wage earner. The countries of Europe prior to the present international war had all practically established some system of social insurance for those wage earners whose annual incomes were less than from \$1200 to \$800. In some instances as in England the state enters with the employer and employe in maintaining the necessary funds while in Germany and other countries the funds are created and maintained by the employer contributing one-third and the employe two-thirds.

In the United States, California has perhaps been the most progressive in this matter, having already established what is known as a social insurance commission.

That many Western power companies have long since voluntarily established or encouraged many of the strongest features of social insurance through their local get-to-gether organizations is most commendable. In its broadest aspects the entire proposition is one that, when kindly and sympathetically treated pays big returns to the utility company. But the matter demands more than a charitable consideration. Fundamentally its principles are sound and deserving of the most thoughtful consideration by all. Upon the happiness and welfare of the wage earner depend practically the happiness, welfare and prosperity of the entire body politic. Anything that can be made to scientifically lessen the seasons of sickness, invalidity, old age or unemployment of the deserving wage earner is to be commended in its highest terms. Indeed its principles are so broad that the state itself should take a hand in seeing to its proper solution.

Prohibitive Power Development

PERSONALS

A. J. Myers, Pacific Coast manager Wagner Electric Manufacturing Company, is at Los Angeles.

Wynne Meredith, member of the firm of Sanderson & Porter, is at San Francisco for a few days from Oklahoma.

Raymond D. Keyser, of the Great Western Power Company at Napa, was in San Francisco this week on business.

Otto J. Hawley, of the Great Western Power Company at San Francisco, has just returned from a short vacation in the East.

Kiyo Sue Inui addressed the Pacific Service, N. E. L. A., on the subject of "A Glimpse of Japan," on August 8th at San Francisco.

C. E. Heise, manager Westinghouse Electric & Manufacturing Company, at San Francisco, is spending his vacation at Santa Cruz.

J. E. Bridges has recently been appointed meter specialist for the San Francisco office of the Westinghouse Electric & Manufacturing Company.

Fred Nelson, of the Great Western Power Company at Oakland is spending his vacation with his family motoring through Southern California.

F. S. Myrtle, publicity manager Pacific Gas & Electric Company, is author of the play to be presented at the Bohemian Club jinks this year.

L. J. Brown, lamp salesman with the Western Electric Company at San Francisco, has returned from the Sunbeam lamp conference at Nela Park, Ohio.

Carl Young, general manager Illinois Electric Company, Los Angeles, leaves this week to visit the Chicago office and to attend the lamp conference at Cleveland.

Waldo C. Cole, salesman with Westinghouse Electric & Manufacturing Company, has been placed in charge of the publicity division of the company's local office.

T. W. Simpson, Pacific Coast manager Federal Sign System (Electric), was at Portland during the past week, having returned to the Pacific Coast from an Eastern trip.

H. F. Hoffland, Pacific Coast manager Simplex Electric Company, has returned to Los Angeles, after disposing of the electric heating stock formerly carried by the Telephone Electric Equipment Company.

B. M. Rastall, who is making an industrial survey for the Chamber of Commerce at San Francisco, was the guest of **S. V. Walton** and **H. P. Pitts** in a trip throughout the San Francisco bay region during the past week.

W. B. Burbeck, of the sales department of the Pacific Gas & Electric Company, is sergeant of the signal corps company from San Francisco at the Mexican border. He has formed a club among Stanford graduates in the militia.

Carl E. Johnson, general manager U. S. Electrical Manufacturing Company of Los Angeles, has returned from a trip to the various electrical centers of the East, where he has been making a study of production methods, material and supply conditions, etc.

O. W. Peterson recently resigned his connection with the Turlock-Modesto irrigation project to take charge of new construction on the Lake Spalding dam of the Pacific Gas & Electric Company, under the direction of **P. M. Downing**, engineer of maintenance and operation.

S. E. Gamble, district manager of the Great Western Power Company at Petaluma, has resigned in order to give more time to the development of some of his own patented inventions. **George Bernhard**, assistant manager at Sacramento, has been promoted to the managership at Petaluma.

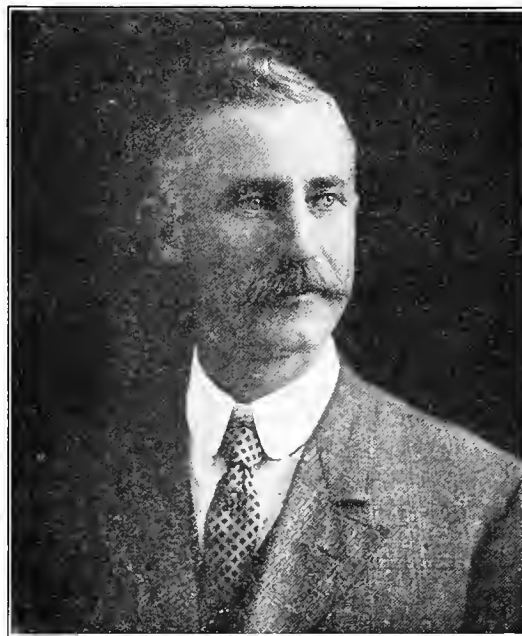
Joseph A. West, formerly chief engineer of the Ogden (Utah) Rapid Transit Company and the Ogden, Logan & Idaho Railway, has been appointed chief engineer of the Sumpter Valley Railroad of Oregon.

S. Blackley, general manager Trumbull & Jones, Ltd., of Melbourne, New Zealand, was at San Francisco during the past week, en route to Pittsburg and Manchester, England, whence he will return to New Zealand early in January. His company represents the British Westinghouse Company in the Antipodes.

C. R. Murray, salesman for the Western Electric Company in the San Joaquin Valley of California, has been unable to be on the job during the past month because of trouble with his eyes. However, he is expected to be out again in a couple of weeks. Meanwhile **R. E. Dryer**, assistant power apparatus salesman, is covering Mr. Murray's territory.

W. W. Briggs, general agent Great Western Power Company, is spending his vacation on the Russian River, and incidentally taking in the jinks at Bohemian Grove. **H. F. Woodward**, district manager at Oakland, is temporarily looking after Mr. Briggs' work, while **J. B. Black**, of the general office, is attending to Mr. Woodward's duties in Oakland.

H. V. Carter, whose resignation as president and general manager of the Pacific States Electric Company was recently announced, is one of the old-timers in the electrical business in the West. Coming to Los Angeles from Canada in 1887, he was first associated with the Los Angeles Gas Saving Asso-



H. V. Carter.

ciation. In 1893 he started his career as a central station man by installing a 30 kw. steam generating plant at Santa Monica, the nucleus of the United Gas Light & Power Company which was later merged into the Southern California Edison Company.

Together with the late Frederick H. Rindge and Geo. I. Cochran he then bought the Long Beach steam plant and also a small plant at Redondo, built a large steam generating station at Santa Monica and a 23,000 volt transmission line which supplied current to Sawtell, Inglewood, Redondo, San Pedro and Long Beach. At about the same time he installed a small hydroelectric plant in connection with the water supply of Monrovia and furnished current for that town. About 1896 Mr. Carter bought the plants of the Santa Barbara Gas & Electric Company, rebuilt and enlarged both the gas and electric generating stations; purchased the Santa Barbara

Street Railway and erected a \$40,000 bath house as a terminal attraction. This combination made a most attractive proposition and Mr. Carter has often been heard expressing regrets that he parted with his Santa Barbara holdings.

In 1900 this and the other companies operated by Mr. Carter under the name of the United Electric Gas & Power Company were merged in the Southern California Edison Company.

Meanwhile Mr. Carter had become interested in and was made president of the Pacific Electrical Works, a large wire insulating mill operated in Los Angeles whose capacity far exceeded the coast demand.

With the relinquishment of his central station duties Mr. Carter took up this losing proposition, gradually converted it into a supply house and in eight years' time built it up into a profitable jobbing house. In August, 1909, the Pacific Electrical Works of Los Angeles was merged with the Sterling Electric Company of San Francisco and the Crescent Electric Company of Oakland to form the present Pacific States Electric Company, with H. V. Carter, president and general manager and W. L. Goodwin vice-president and sales manager. Under this capable and energetic management the company is now doing the largest electrical supply jobbing business in the Pacific Coast, stores being operated at Seattle, Portland, Oakland, San Francisco and Los Angeles. This interesting bit of biography is an essential part of the electrical history of the West. Mr. Carter's present retirement comes in connection with disposing of all his holdings in the company and closes another chapter in an eventful life.

Colonel Carter has numerous other interests, especially in Southern California, being vice-president of the Seaside Water Company and the Long Beach Bath House & Amusement Company. He is also a director in the Seaside Investment Company, which owns the beautiful Hotel Virginia.

His many friends are now wondering what he will do next, but this, like the manner of acquiring his military title must for the present remain a matter of speculation.

PROGRAM PACIFIC COAST CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

September 5, 6, 7, 8.

Tuesday, September 5th.—Morning Session.

10:00 a. m.—Registration; Opening of Convention.

11:00 a. m.—Address of Welcome; Response; Address, President H. W. Buck; Paper, A Distribution System for Domestic Power Service from Commercial and Engineering Standpoints, by Carl H. Hoge and Edgar R. Perry.

Afternoon Session, 2:00 to 5:00.

Paper: Some Features of Domestic Electric Cooking and Heating, by H. B. Pierce; Paper: Temperature Rise of Insulated Lead Covered Cables, by Richard C. Powell; Discussion.

Wednesday, September 6th.—Morning Session 10:00 to 12:00.

Paper: Inductive Interference as a Practical Problem, by A. H. Griswold and R. W. Mastick; Discussion.

Afternoon Session.—2:00 to 5:00.

Paper: Testing for Defective Insulators on High Tension Transmission Lines, by B. G. Flaherty; Paper: High Voltage Potentiometer, by Harris J. Ryan; Paper: Artificial Transmission Line with Adjustable Line Constant, by C. E. Magnusson and S. R. Burbank; Discussion.

Thursday, September 7th.

The program will be supplied for both morning and afternoon sessions by the Pacific Northwest Electric Light & Power Association.

Evening, 8:00.—Lecture by Henry Suzzallo, President University of Washington—The Engineer and the Public; Lecture by W. D'A. Ryan—Illumination of the Panama-Pacific Exposition.

Friday, September 8th.—Morning Session 10:00 to 12:00.

Paper: Characteristics of Admittance Type of Wave Form Standard, by Frederick Bedell; Paper: Investigation with Transients, by W. D. Peaslee; Discussion.

Afternoon Session.—Automobile trip and boat ride. Evening, Banquet.

In addition to the technical program numerous entertainment features are being provided for the delegates and ladies in attendance.

TRADE NOTES.

The city of Redding, not to be outdone by its neighbor, Red Bluff, intends installing an up-to-date street lighting system and has placed an order for ornamental steel electroliers with the Pacific States Electric Company. These standards will support G. E. Novalux fixtures with compensator for operating either 400 or 600 c.p. series lamps.

The Petroleum Rectifying Company of California has acquired by purchase the United States patents for the Dehydration of Oil formerly owned by the Raney-Laird Petroleum Dehydrating Company. The Traders Oil Company which has been operating a Raney-Laird plant for something over a year has taken a license under the Cottrell patents owned by the Petroleum Rectifying Company, and the infringement suit between these companies will be dropped. The system of removing water from oil by electricity is a purely California conception which has brought about a revolution in the oil industry in this country and abroad. The settlement of the litigation with the Raney-Laird interests will promote further advances in the art due to a combination of the two systems under a strong corporation.

NEW CATALOGUES AND BOOKS.

The Edison Storage Battery Company, Orange, N. J., has just issued a beautiful and interesting treatise on storage batteries in railroad service. "Train Lighting Batteries, Edison," is handsomely illustrated with photographs showing the batteries in actual service, as well as the construction of the individual cell. The text is especially comprehensive and valuable to any railroad man having to do with storage batteries, embracing a thorough description of the manufacture of the cells, their characteristics, battery troubles and their elimination, and giving special attention to the chemical changes involved on charge and discharge. The booklet contains thirty-two pages and is replete with illustrations.

When the large Auditorium at the University of Illinois was built in 1908 it proved to be unsatisfactory in its acoustical properties. Audiences found it difficult to hear speakers owing to marked reverberation and echoes. Dr. F. R. Watson of the Physics Department and James M. White, supervising architect, undertook to correct the fault by conducting a systematic investigation involving a long series of experiments. "Bundles" of sound were projected in different directions and the paths of these were carefully traced. Various instruments, such as a ticking watch, a hissing arch lamp and megaphones were employed and curtains and draperies were hung at critical points suggested by the diagnosis.

Certain of the walls were then covered with hairfelt mounted on thin furring strips with the result that at present a speaker with a moderate voice may be heard distinctly by auditors in the most distant seats of the large building.

The investigations are described in an illustrated booklet issued by the Engineering Experiment Station as Bulletin No. 87. Copies may be had by addressing W. F. M. Goss, Director, Urbana, Illinois.



NEWS NOTES



ILLUMINATION.

SAN RAFAEL, CAL.—The board of supervisors is advertising for bids for installing and caring for 20 lights in Laverne Lighting District of Marin county.

LOS ANGELES, CAL.—Sealed bids will be called for by the board of public service commissioners for furnishing transformers, in accordance with specifications on file.

HAYWARD, CAL.—A new system of electroliers in place of the present overhead lighting will probably be installed following an investigation of the Hayward Chamber of Commerce.

OROVILLE, CAL.—The Pacific Gas & Electric Company has instituted suit in the Superior Court against Henry W. Taylor and Ella C. Taylor to condemn certain land near De Sabla, which they desire to use as a site for a dam in Butte Creek.

GOLDFIELD, NEV.—J. B. Fayant has filed a petition with the board of county commissioners asking for a franchise to construct and maintain, gas mains and all necessary appliances used in connection therewith, in streets and alleys of Goldfield.

LAGUNA BEACH, CAL.—Notice is given that an election will be held here on August 22 for the purpose of determining the question of the formation of a highway lighting district to be known as Laguna Beach Lighting District of Orange county.

LOS ANGELES, CAL.—Plans for the construction of a three-story addition and for alterations to the present building of the California Edison Company on Fourth street, between Main and Los Angeles, are being prepared. The estimated cost is not yet known. The present structure will be transformed into an up-to-date five-story office building.

RIVERSIDE, CAL.—Amended articles of incorporation have been filed by directors of the Banning Gas & Lighting Company. The principal place of business of the company is Banning. Capital stock, \$25,000. Directors include C. D. Hamilton, C. S. Holcomb, D. A. Innes, J. M. Westerfield and Dr. J. C. King. D. H. Gates is president and Paul Aylesworth, secretary.

FRESNO, CAL.—The San Joaquin Light and Power Corporation is making rapid progress in the work of laying 40 miles of mains for natural gas in the neighborhood of San Luis Obispo. Natural gas is to be piped from the Santa Maria fields to San Luis Obispo, the Eastern Oil Refinery, Pismo, Haviland, Port San Luis and Oceano for domestic use. The work will be completed within a month.

TRANSMISSION.

KINGMAN, ARIZ.—The Burro Creek Hydroelectric Power Company has secured authority from the Arizona corporation commission to proceed with its enterprise in the Oatman district.

LOS ANGELES, CAL.—A permit has been issued to the city to build a \$50,000 electrical substation at 1636 St. John street. The power will enter the city through this main substation with strength of 100,000 volts, and will be distributed through the local station of 30,000 volt lines.

SANTA BARBARA, CAL.—Announcement has been made that the San Joaquin Light & Power Company has purchased the material necessary and is soon to extend its lines to the northern parts of the county. New extensions are planned to reach down into Los Alamos, Los Olivos, Santa Ynez, and Solvang.

WINNEMUCCA, NEV.—Edson F. Adams, president; B. Brown, vice-president and Joseph Beau, general manager of

the Nevada Valleys Power Company, are in Winnemucca. It is understood that the company is contemplating extending their electric power line from Rochester to Battle Mountain, passing Winnemucca.

SALEM, ORE.—A permit has been issued to the Idaho Power Company, a \$17,000,000 corporation organized under the laws of Maine, to transact business in Oregon, by Corporation Commissioner Schulderman. John A. Laing of Portland is the company's representative in Oregon.

VISTA, CAL.—The transmission lines of the San Diego Consolidated Gas & Electric Company, now being extended from Del Mar to Oceanside, are to be brought inland to Vista and connected with the Oceanside distributing system in the San Luis Rey valley. It is also probable that the lines may be extended to the Twin Oaks, Escondido and San Pasqual valleys. Extensions of lighting and power current are expected to be made in a number of directions with Oceanside as a distributing center.

SAN FRANCISCO, CAL.—The Coast Counties Gas & Electric Company, which distributes electricity and gas in Santa Cruz, Monterey, San Benito and Santa Clara counties and has its principal office in San Francisco, has filed with the Railroad Commission an application for an extension until December 31 of the time in which it may sell first preferred stock heretofore authorized by the commission to be disposed of before June 30. The commission some time ago gave the company permission to sell 1000 shares of this stock at not less than 85 per cent of its par value, and the company reports that it has already sold 852 shares at \$90, or \$5 a share more than the minimum fixed by the commission. It wishes more time to sell the other shares.

IRRIGATION.

EL CENTRO, CAL.—Officials of the Imperial Irrigation District have received word from the Secretary of War Department permitting the district to construct a temporary rock and pile weir across the Colorado River at Hanlon Heading.

SACRAMENTO, CAL.—At a meeting held in Herald, this county, an irrigation district, comprising about 40,000 acres in the southwestern part of the county, was organized. E. R. Walker, representing the Hobart-Hayward-Lane interests, has been promoting the project.

MARYSVILLE, CAL.—Close to 20,000 acres of land in Yuba county will be irrigated by the big irrigation ditch which is being planned in Butte and Yuba counties. The ditch is to leave the Feather River on the Oroville side of Pacific Heights. There will be 16 miles of main ditch to be built in Butte county.

AUBURN, CAL.—The Pacific Gas & Electric Company is actively engaged in the western part of the county signing up farmers and land owners for irrigation. It is stated that the company has sufficient water available to irrigate 35,000 acres in the western part of the county, which is 15,000 acres more than is being irrigated in the Auburn unit.

MODESTO, CAL.—The Waterford irrigation district organized two years ago, has been approved by State Engineer W. F. McClure in his report on the practicability of the district just received. Completion of the project will add 14,000 acres of fertile lands to the irrigated area of Stanislaus. The bond issue will be \$465,000, as already figured by the district's engineer and by the state engineer. The necessary petitions calling for the election will be circulated at once.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
7

Flexible Steel-Armored Conductors.		
	Cost.	Sell.
No. 18. 2-Conductor Cord, per 100...	8.00
No. 14. 2-Conductor Solid, per 100...	14.65
No. 12. 2-Conductor Solid, per 100...	16.20
No. 10. 2-Conductor Solid, per 100...	24.95
No. 14. 3-Conductor Solid, per 100...	18.40
No. 12. 3-Conductor Solid, per 100...	25.50
No. 10. 3-Conductor Solid, per 100...	35.45

Conduit Fittings.

Bushings Porcelain Lined.		
1/2 in. ....	.....	.25
3/4 in. ....	.....	.35
1 in. ....	.....	.50
1 1/4 in. ....	.....	.65
1 1/2 in. ....	.....	.90
2 in. ....	.....	1.20
2 1/2 in. ....	.....	1.65
3 in. ....	.....	4.00

Non-Metallic Flexible Conduit.

Full Coils 25% Off.		
	Per 100	Per 100
2/8 in.	\$ 5.50
5/16 in.	6.00
3/8 in.	9.00
1/2 in.	12.00
Ordinary Fastener	2.00
Universal Fastener	3.00

Couplings—Each.

1/2 in. ....	.07
3/4 in. ....	.10
1 in. ....	.13
1 1/4 in. ....	.17
1 1/2 in. ....	.21
2 in. ....	.28
2 1/2 in. ....	.40
3 in. ....	.60
3 1/2 in. ....	.80
4 in.	1.00

The correctness of these suggested selling prices is not guaranteed by the publisher.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
8

Elbows—Each.

	Cost.	List.	Sell.
1/2 in.19	.19
3/4 in.25	.25
1 in.37	.37
1 1/4 in.45	.45
1 1/2 in.60	.60
2 in.	1.10	1.10
2 1/2 in.	1.80	1.80
3 in.	4.80	4.80
3 1/2 in.	10.60	10.60
4 in.	12.25	12.25

Conduit Bushings—Per 100.

1/2 in.	\$ 4.50
3/4 in.	8.00
1 in.	15.00
1 1/4 in.	18.50
1 1/2 in.	20.00
2 in.	40.00
2 1/2 in.	60.00
3 in.	90.00
3 1/2 in.	150.00
4 in.	200.00
4 1/2 in.	400.00

Steel Conduit Locknuts—Per 100.

1/2 in.	1.50
3/4 in.	2.50
1 in.	5.00
1 1/4 in.	8.00
1 1/2 in.	12.00
2 in.	20.00
2 1/2 in.	30.00
3 in.	40.00
3 1/2 in.	60.00
4 in.	100.00

No Thread Nipples—Each.

1/2 x 1/2 .....	.20
1/2 x 3/4 .....	.25
3/4 x 3/4 .....	.25

No Thread Couplings.

1/2 .....	.40
3/4 .....	.50

The correctness of these suggested selling prices is not guaranteed by the publisher.

Fold Here

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

- | | | | |
|-----|---|-----|--|
| A-1 | American Ever-Ready Works of National Carbon Co.,
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-3 | Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland,
Kearns Bldg., Salt Lake City; Sheldon Bldg., San Fran-
cisco; Mutual Life Bldg., Seattle; Santa Rita Hotel
Bldg., Tucson. |
| A-2 | Atchison, Topeka & Santa Fe Railway Co.....
673 Market St., San Francisco; 1218 Broadway, Oakland. | N-1 | Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| B-1 | Baker-Joslyn Company..... 2
71 New Montgomery St., San Francisco; 911 Western
Ave., Seattle; 353 E. Second St., Los Angeles. | N-6 | National Carbon Company..... 5
Cleveland, Ohio. |
| B-2 | Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco. | N-2 | National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San
Francisco. |
| C-1 | Century Electric Co..... 2
906 So. Hope St., Los Angeles; 56 Natoma St., San Fran-
cisco; 65 Front St., Portland, Ore. | N-3 | National Lamp Works of G. E. Co.....
(All Jobbers.) |
| C-3 | Crocker-Wheeler Co.....
87 New Montgomery St., San Francisco; 228 Central
Avenue, Los Angeles. | N-4 | New York Insulated Wire Co.....
629 Howard St., San Francisco. |
| C-4 | Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland,
Ore.; San Fernando Bldg., Los Angeles. | N-5 | Northwestern Pacific Railroad.....
808 Phelan Bldg., San Francisco. |
| D-4 | Davis Slate & Manufacturing Co.....
Chicago, Ill. | O-1 | Okonite Co. (The)..... 12
(All Jobbers.) |
| D-2 | Dearborn Drug and Chemical Works..... 4
355 East Second St., Los Angeles; 301 Front St., San
Francisco. | P-1 | Pacific Electric Manufacturing Co.....
80 Tehama St., San Francisco. |
| E-7 | Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago. | P-2 | Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth
St. No., Portland; 200-210 Twelfth St., Oakland; 575
Mission St., San Francisco; 307 First Ave. So., Seattle. |
| E-1 | Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los
Angeles. | P-4 | Pelton Water Wheel Co..... 3
2219 Harrison St., San Francisco. |
| E-2 | Edison Storage Battery Supply Co..... 4
441 Golden Gate Ave., San Francisco. | P-5 | Pierson, Roeding & Co.....
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San
Francisco; Colman Bldg., Seattle. |
| E-3 | Electric Agencies Co.....
247 Minna Street, San Francisco; Central Building,
Los Angeles. | P-6 | Pittsburgh Electric Specialties Company.....
202 Aronson Bldg., San Francisco. |
| E-6 | Electric Novelty Works.....
533 Mission St., San Francisco. | P-7 | Pittsburgh Piping & Equipment Co..... 12
Monadnock Bldg., San Francisco. |
| E-4 | Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco. | S-1 | Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco. |
| E-5 | Electric, Railway & Manufacturing Supply Co..... 4
34 Second St., San Francisco. | S-4 | Southern Pacific Co..... 4
Flood Bldg., San Francisco. |
| F-1 | Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission St., San Francisco;
Seattle; Spokane. | S-5 | Sprague Electric Works..... 12
Rialto Bldg., San Francisco; Colman Bldg., Seattle;
Corporation Bldg., Los Angeles; Electric Bldg., Port-
land; Paulsen Bldg., Spokane. |
| F-3 | Federal Sign System (Electric).....
618 Mission St., San Francisco. | S-6 | Standard Underground Cable Co..... 4
First National Bank Bldg., San Francisco; Hibernian
Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815
Newhouse Bldg., Salt Lake City, Utah. |
| G-1 | General Electric Co..... 3-10-11
724 So. Spring St., Los Angeles; Worcester Bldg., Port-
land; Rialto Bldg., San Francisco; Colman Bldg.,
Seattle; Paulsen Bldg., Spokane. | T-1 | Thomas & Co., R..... 12
Pacific States Electric Co. and Western Electric Co.,
Pacific Coast Representatives. |
| G-1 | General Vehicle Co.....
1117 Van Ness Ave., San Francisco; 331 Wall St., Los
Angeles; British Columbia Electric Ry., Ltd., Van-
couver, B. C. | T-2 | Tubular Woven Fabric Company.....
Pawtucket, R. I. |
| H-1 | Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.) | U-1 | United Sheet Metal Works.....
575 Howard St., San Francisco. |
| H-2 | Hemingray Glass Co..... 3
236-240 So. Los Angeles St., Los Angeles; 345 Oak St.,
Portland; 807 Mission St., San Francisco. | W-1 | Wagner Electric Manufacturing Company..... 12
St. Louis, Mo. |
| H-3 | Haller-Cunningham Electric Co.....
428 Market St., San Francisco. | W-2 | Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph
Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907
First Ave., Seattle; 45 North Fifth St., Portland, Ore. |
| H-5 | Hunt, Mirk & Co.....
141 Second St., San Francisco. | W-3 | Ward-Leonard Electric Co..... 5
Mt. Vernon, New York. |
| H-7 | Hurley Machine Co.....
New York and Chicago. (See Pacific States Electric Co.) | W-4 | Westinghouse Electric and Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los
Angeles; Couch Bldg., Portland; 212 So. W. Temple,
Salt Lake City; 165 Second St., San Francisco; Second
and Cherry Sts., Seattle; Paulsen Bldg., Spokane. |
| I-2 | Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles. | W-5 | Westinghouse Machine Co.....
141 Second St., San Francisco. |
| I-3 | Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco. | W-6 | Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.) |
| L-1 | Leahy Manufacturing Co.....
Eighth and Alameda St., Los Angeles. | W-8 | Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway,
Los Angeles. |
| L-2 | Locke Insulator Manufacturing Co..... 5
(See Pierson, Roeding & Co.) | | |
| M-2 | McGlauffin Manufacturing Co.....
Sunnyvale, Cal. | | |
| M-4 | Morse Chain Company.....
Monadnock Bldg., San Francisco. | | |

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXVII No. 8

SAN FRANCISCO, AUGUST 19, 1916

PER COPY, 25 CENTS

BERKELEY'S ORNAMENTAL LIGHTING SYSTEM.

BY T. M. STATELER.

MAGNETIC PERMEABLE CYLINDRICAL CONDUCTORS.

BY CLEM A. COPELAND.

"COOKING BY WIRE" AT PORTLAND.

BY GEORGE G. BOWEN.

UNDERGROUND WATERS.

BY S. T. HARDING.

AN ELECTRIC APPLIANCE CAMPAIGN.

MATERIALS ADVERTISED IN THIS ISSUE

Aluminum Arresters

General Electric Co.

Armored Conductors

Sprague Electric Co.

Batteries

Edison Storage Battery Co.

Boiler Feed Water Treatment

Dearborn Chemical Co.

Electrical Supplies

Electrical Ry. & Mfrs. Supply Co.
Pacific States Electric Co.
Pierson, Roeding & Co.

Lamps

National Lamp Works.

Insulators

Hemingray Glass Co.
Pierson, Roeding & Co.
Locke Insulator Mfg. Co.
Pacific States Electric Co.

Luxsolite Fixtures

Westinghouse Elec. & Mfg. Co.

Machinery

Buckhorn Mining Co.

Motors

Century Electric Co.
Crocker-Wheeler Co.

Piping

Pittsburg Piping & Equipment Co.
Schaw-Batcher Pipe Works

Pole Line Material

Baker-Joslyn Co.
Pierson, Roeding & Co.

Power Plants

Chas. C. Moore & Co.

Resistance Units

Ward Leonard Electric Co.

Transportation

Southern Pacific Co.

Turbines

Pelton Water Wheel Co.

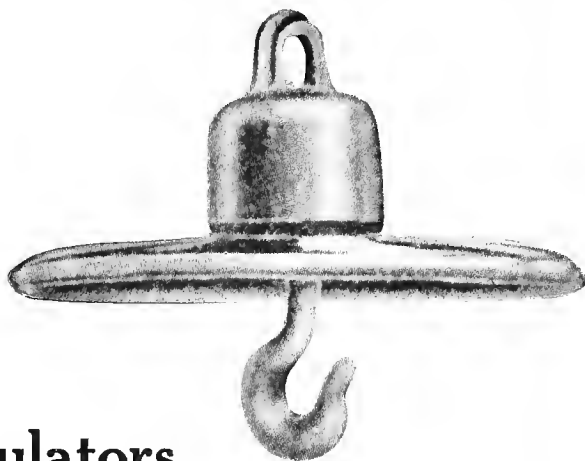
Wire and Cable

The Okonite Co.

THOMAS

Builds Quality Insulators —

Pacific States Electric Company
Service sells them.



Thomas High Tension Insulators

are built to meet the demands of the
Most Exacting Engineer

*Many types can be promptly delivered from our
Pacific Coast Stocks*

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

LOS ANGELES

OAKLAND

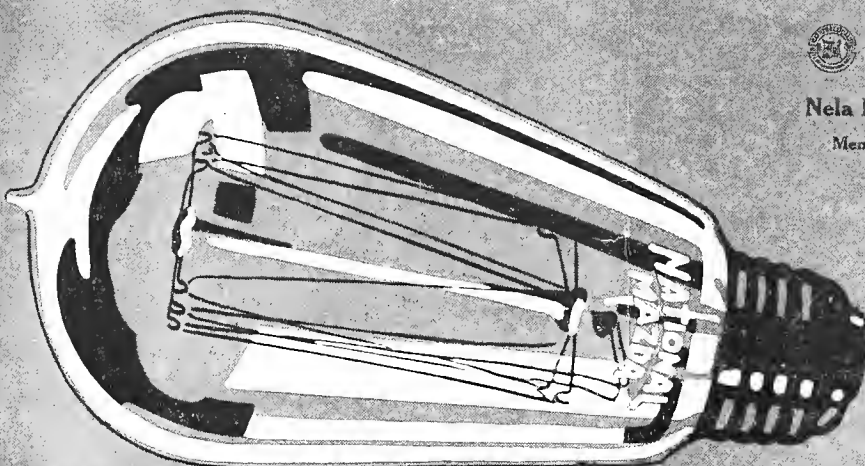
PORTLAND

SAN FRANCISCO

SEATTLE

NATIONAL MAZDA LAMPS

THE WAY TO BETTER LIGHT



NATIONAL LAMP WORKS
OF GENERAL ELECTRIC COMPANY

Nela Park,

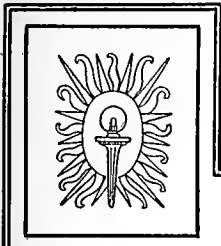
Cleveland

Member Society for Electrical Development

"DO IT ELECTRICALLY"

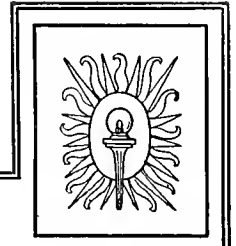
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JOURNAL OF ELECTRICITY

POWER AND GAS



Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXVII

SAN FRANCISCO, AUGUST 19, 1916

NUMBER 8

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BERKELEY'S ORNAMENTAL LIGHTING SYSTEM

BY T. M. STATELER.

(This contribution to the literature of street illumination describes a recent series lighting installation equipped with special transformers and new protective devices. The author is illuminating engineer with the Pacific States Electric Company at San Francisco.—The Editor.)

The city of Berkeley, California, has recently completed a street lighting system in the exclusive Claremont residence section that is worthy of mention. This section of Berkeley lies largely in the low approaches of the Coast Range, which are immediately

series lamp. In addition to these lamps 18 electroliers installed some years ago were changed over from multiple to series and connected with the new system.

The entire system was segregated into five separate loops with approximately one-fifth of the total



A Typical View of Berkeley's Beautiful Ornamental Residence District.

back of the east bay cities, and affords most advantageous villa sites, with views of bay and ocean that will compare favorably with any throughout the world. Some of the most beautiful mansions on the Pacific slope are to be found in this district.

Due to the contour of the land and the fact that many of the streets are narrow and laid out in broad curves, it was not deemed necessary to place the lamps as close together as is customary and a large area was lighted with a comparatively small number of units.

Two hundred thirty six steel standards have been installed, each supporting a 16 in. ball globe with ventilating cap; 88 standards carrying a 250 c.p. 7.5 ampere series lamp and 148 equipped with 100 c.p. 7.5 ampere

lamps on each loop, each supplied by an individual S. L. transformer built by the General Electric Company especially for this installation and supplied and installed by the Pacific Gas & Electric Company. The primary windings of the transformers are connected in series with the existing 7.5 ampere arc lamp circuits, being designed for a 1:1 ratio of current transformation. The lamps are connected in series on the secondaries of these transformers. This plan prevents the high voltage of the series arc circuit from being impressed on the incandescent lamp system, thus saving in cost of insulation and increasing the safety of this system.

While these 1:1 series transformers, known as

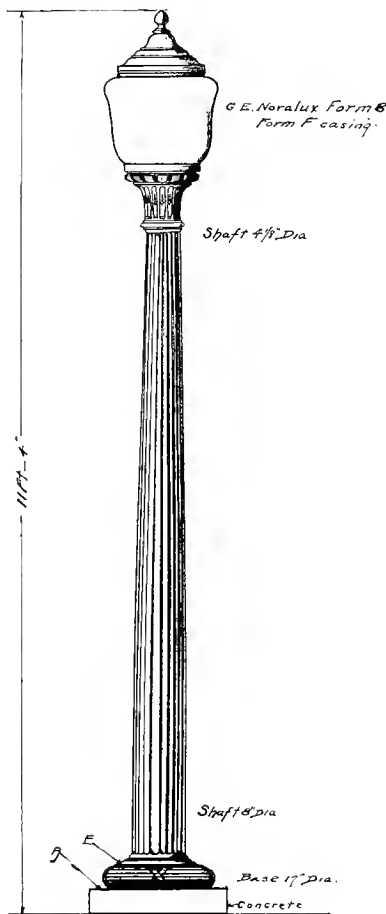
type S. L. had been in general use for a number of years, this is the first time they have been used in such large sizes. The Claremont lighting project employs one 5 k.v.a., two $7\frac{1}{2}$ k.v.a., and two 10 k.v.a., type S.L. transformers.

Each incandescent lamp is provided with a device in the socket known as a "film cutout." In case a lamp burns out the cutout will automatically complete the circuit through the socket without interfering in the least with the other lamps on the circuit.

Likewise, a protective device is used with each type S.L. transformer so that in case its secondary circuit is open for any cause, the entire transformer will be shorted out and operation of the remainder of

wider streets. They are simple in design, consisting of a modified Corinthian capital, fluted shaft made with correct entasis and stopped flutes gracefully tapered and correctly proportioned throughout. Most standards in the past have presented an appearance all out of proportion to the ball globe and in making the selection of the Claremont standard the Civic Art Commission of Berkeley considered that out of a large number of designs the one selected more nearly filled all requirements than any other submitted. They were manufactured by the Union Metal Company and are made of high grade copper-bearing non-oxidizing pressed steel.

The cable employed, manufactured by the General Electric Company, was No. 8 B. & S. gauge $\frac{3}{64}$ in. rubber insulated protected with a lead sheath $\frac{5}{64}$ in. in thickness. When it was necessary to cross the street



Typical Lamp Design

the series arc circuit and other type S.L. transformers not interfered with. This also prevents the danger of high voltage on the incandescent lamp circuit which normally would occur with a series transformer operating with open circuited secondary. The film cutouts used for these protective devices were developed in the research laboratory of the General Electric Company especially for the Claremont system, as they required a much higher breakdown voltage than the cutouts in general use for single series lamps. These special film cutouts consist of two discs of metal, separated by insulation with pointed indentations spaced so that arcing will occur at the breakdown voltage for which they are designed.

The standards are spaced about 200 ft. apart, staggered, and are of two heights, 10 and 12 ft. to lamp filament, the higher standards being located on the



Typical Lighting Standards as Installed.

to an electrolier duplex cable was used and a T joint made in a cast iron junction box in the main runway, the box being filled with pothead compound when joint was completed. This cable is built to withstand a pressure of 2500 volts and factory specifications called for a test of 5000 volts. The city engineer's specifications called for cable to show an insulation resistance ground. Cable was drawn into 1 in. and $1\frac{1}{4}$ in. hot dipped galvanized electrical conduit, and altogether about 11 miles of street is lighted.

The system presents an excellent appearance by day and at night illumination has proved most efficient. No attempt has been made to light the street and sidewalk spaces brilliantly, but to imitate as far as possible the soft diffusion of full moonlight and the result has been very successful.

In considering this installation, Mr. Fred T. Robson, commissioner of public works, Berkeley, insisted that the cost be kept within a price of 30c per front foot and how well his engineering department planned is shown by the fact that the ultimate cost to the property owners was but 27.6 per lineal foot. The work was originally conceived by Mr. Robson and his plans were carried out to a successful conclusion by the able members of his engineering staff, J. J. Jessup, city engineer and his assistant, E. N. Prouty, and to these gentlemen the writer is indebted for the information contained in this article. The Pacific Fire Extinguisher Company were the contractors on the job.

MAGNETIC PERMEABLE CYLINDRICAL CONDUCTORS.

BY CLEM A. COPELAND.

(Hitherto in his treatment of skin effect, the author has limited his discussion to considerations of non-magnetic materials. In this article, however, he boldly steps forth into a discussion of the phenomena of skin effect in their bearing upon conductors composed of magnetic material. His conclusions have an important practical bearing when such installations as the steel cables of Carquinez crossing and similar structures are considered.—The Editor.)

Solid Wires or Rods and Cables.

The introduction of μ , the permeability of iron steel, nickel and cobalt into the argument κ , thus:

$$\kappa = 22.570 \sqrt{\mu f / 10^9 \rho}$$

has often been assumed, to result in finding K_R and K_L by reference to Table I. Many published papers have inherited, one after another, this popular fallacy, or at least by the use of μ in various skin effect formulae, have created the impression that it was only necessary to insert some value say $\mu = 500$ in the formulae to determine the skin effect.

This however is impracticable since the development of all skin effect formulae assumes some hypothetical medium which has a constant permeability for all values of magneto-motive-force that is, for all values of current in the conductor which produces the lines of force within it. Practically this is only so when μ is unity, as in copper and other non-permeable substances.

Curiously enough, in the special case of low current strength in small permeable wires the skin effect on the internal self-induction; and therefore on K_L is as though μ was constant up to a current strength

of about .4 of an ampere in No. 5, and as high as .75 and 2.0 amperes in No. 9 and No. 14 B. W. G. "B. B." iron wires respectively, even with frequencies as high as 140. Thus Kennelly states that a number of measurements upon ordinary iron telephone and telegraph wires with these feeble currents seem to show that μ has a constant average value of about 150. This fact however does not apply to the determination of K_R and is of no practical use, especially as μ varies widely from the average of 150 for small currents in different qualities of iron and steel and different sizes of the same quality and one may better find K_R and K_L directly by test or from the curves which follow (which have been established by tests) than to determine μ by test and insert it in any formula.

That skin effect formulae practically are inapplicable to permeable substances is readily seen to be due to the fact that at every instantaneous value of the current throughout a complete cycle there exists a different value of μ along the permeability curve. The result is complicated by the hysteresis loss during the cycle of magnetization, demagnetization, reversal, remagnetization and redemagnetization. K_R and K_L are therefore intricate functions of the current as well as r , μ , f and $10^9 \rho$.

If a curve be plotted with currents, I as ordinate and $K_R = \text{ratio } R_{ac}/R_{dc}$ as abscissae, it will follow the general trend of a (μ, H) curve as would be expected; in fact at every value of I , knowing K_R experimentally, a so-called equivalent (μ, H) curve can be plotted by means of the argument κ and Table I. Such curves have been plotted by the U. S. Bureau of Standards and are shown to have the same trend as the (K_R, I) curves shown herewith. It should be

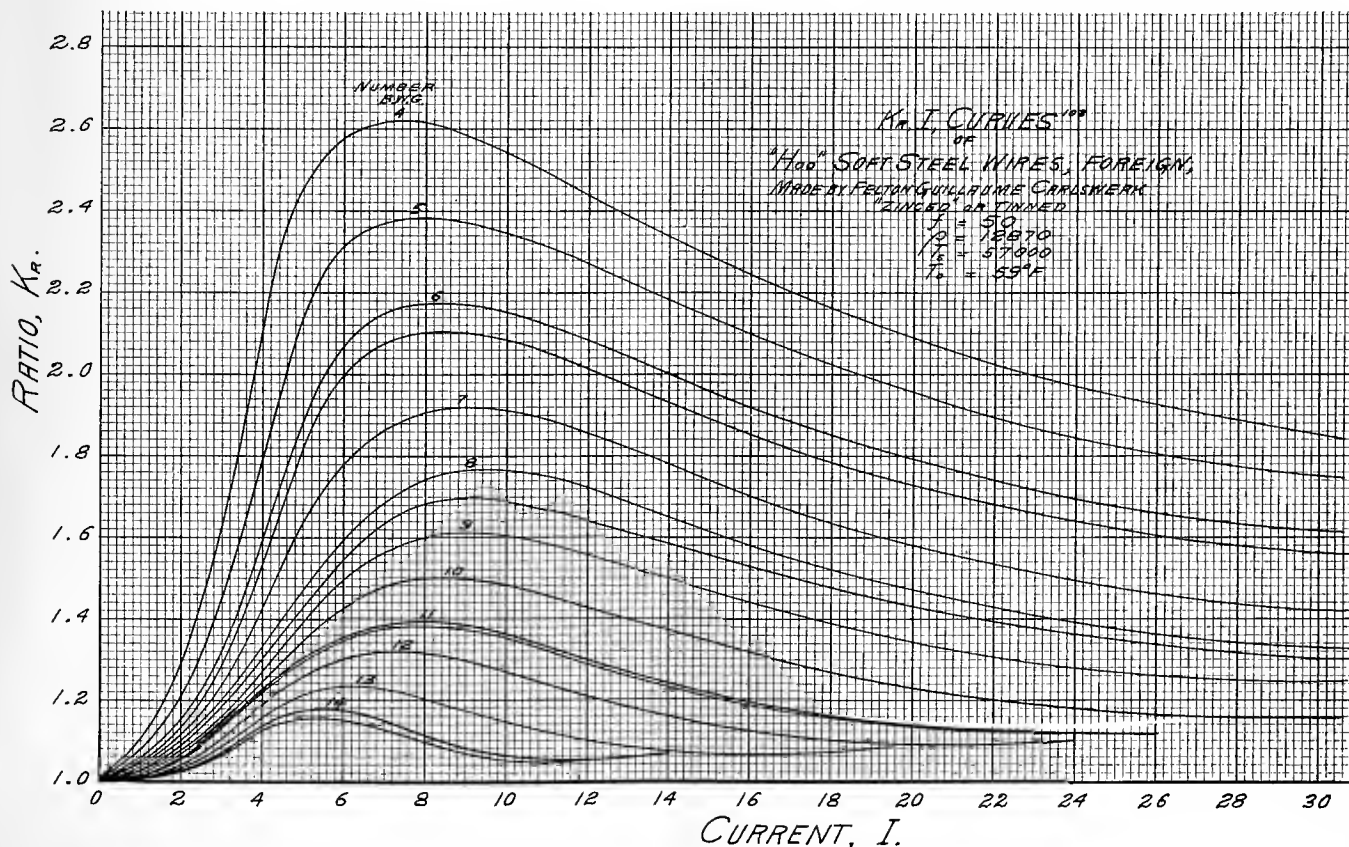


Fig. 6.

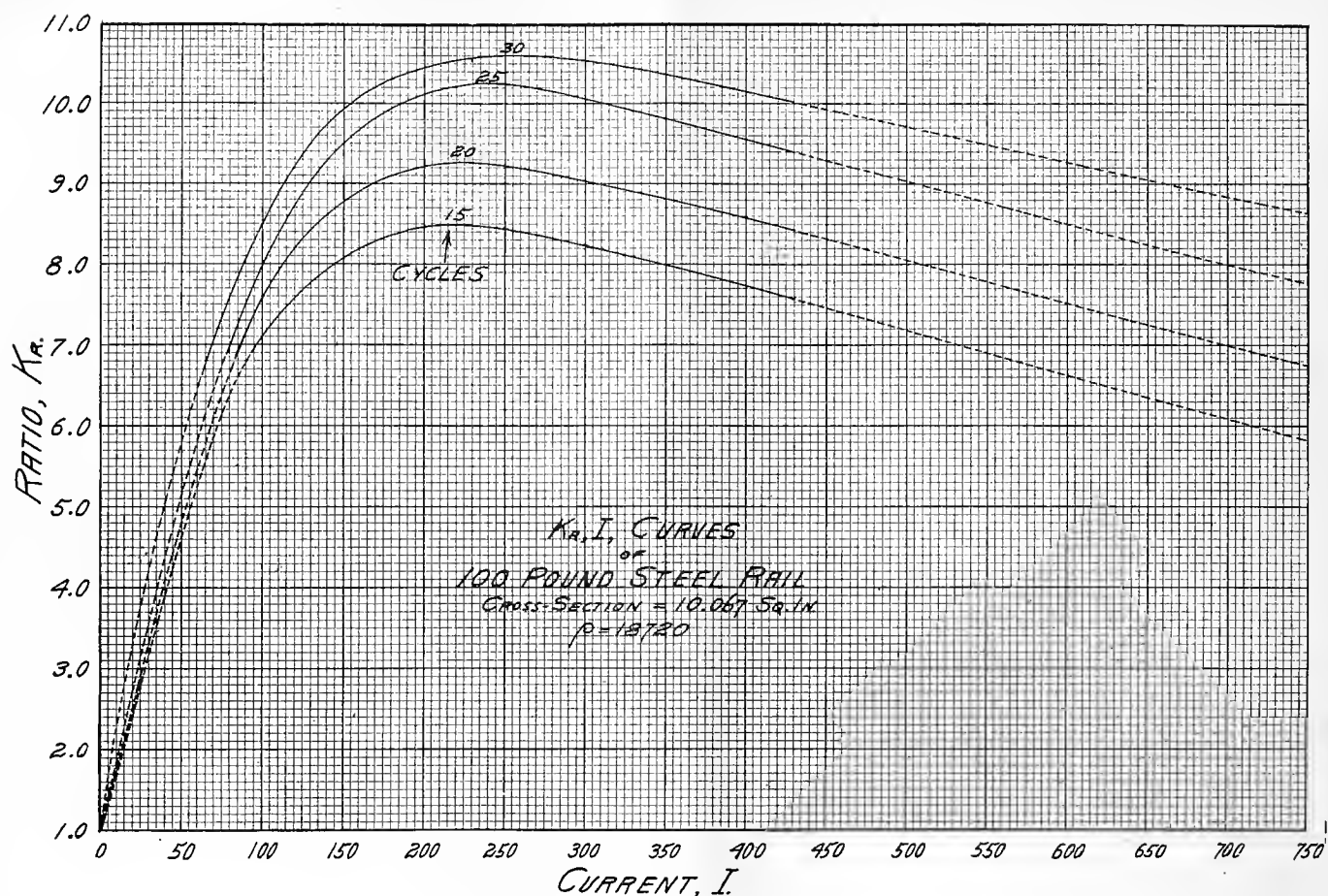


Fig. 7.

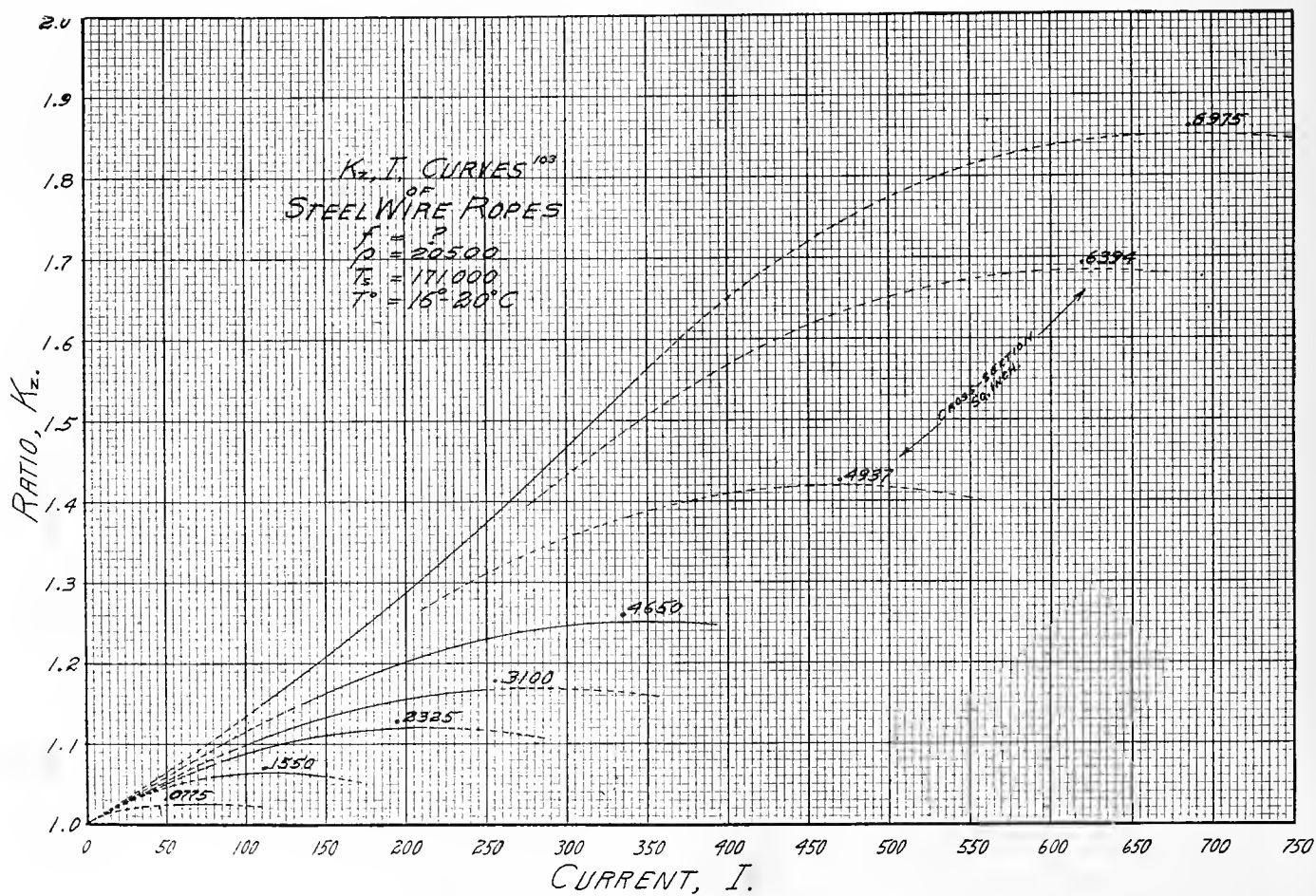
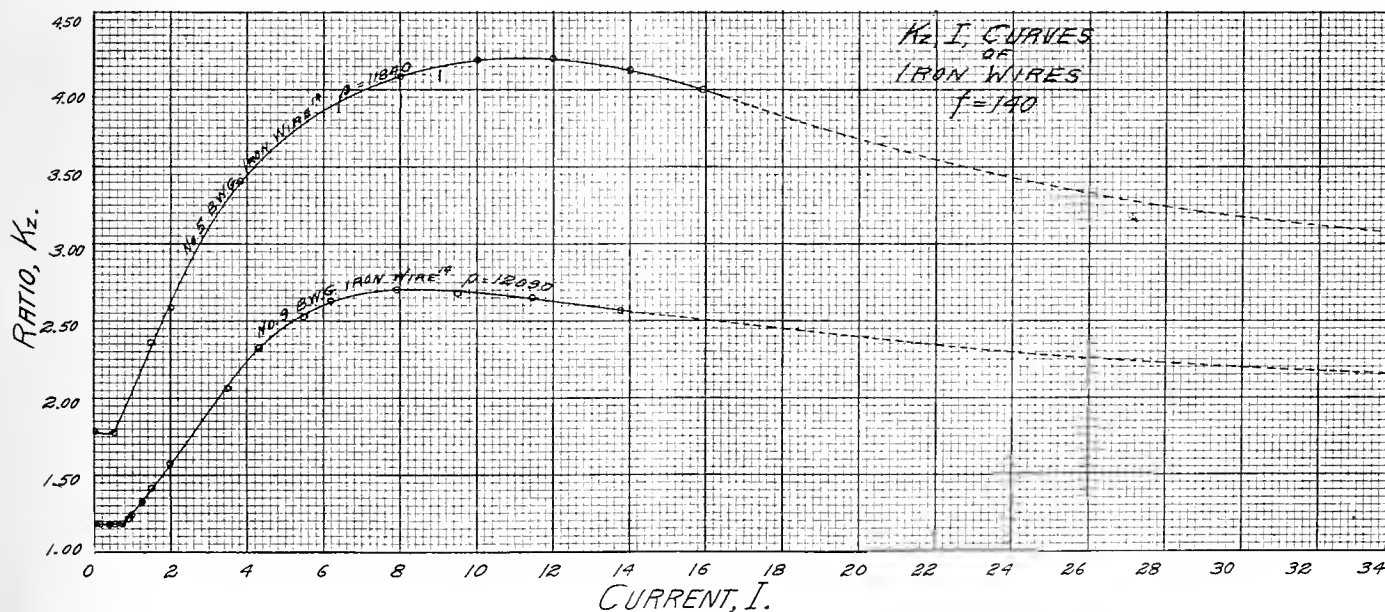
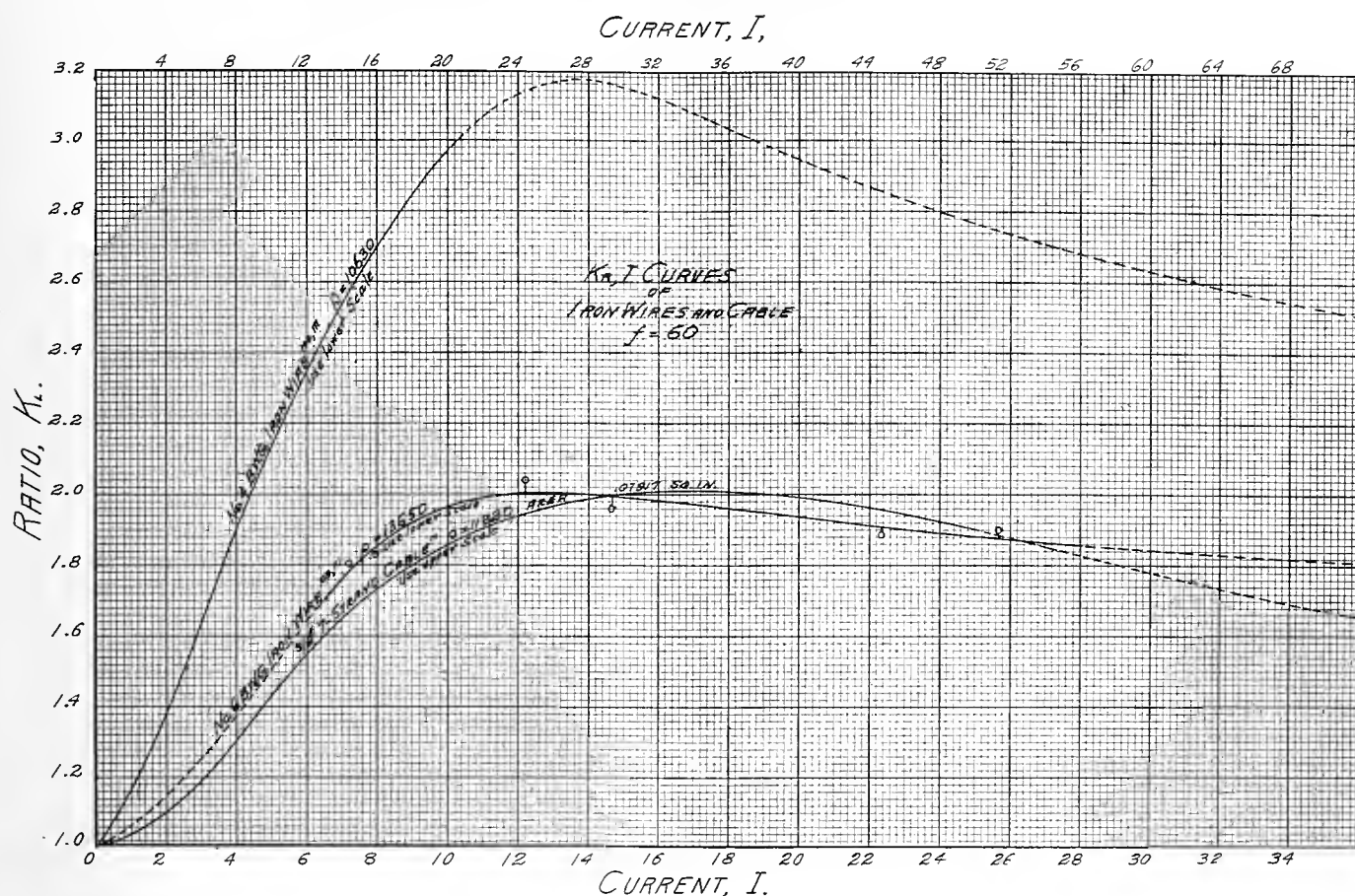


Fig. 8.



noticed that these (μ, \mathbf{I}_c) curves exhibit the phenomena of circular transverse concentric magnetization and are materially different from a (μ, H_c) curve of magnetization as usually taken when the lines extend along the conductor axially, as already pointed out by the Bureau.

In Fig. 6 is shown a nest of ($\mathbf{K}_R, \mathbf{I}_n$) curves taken at 50 cycles on various sizes of wires of a soft pure grade of galvanized iron having an ultimate tensile strength of 57,000 pounds and a specific resistance of $10^9 \rho = 13,500$ abohms per centimeter cube or 12.90%

conductivity with respect to pure copper. The unnumbered curves are those for wires of .2, .3, .4 and .5 cm. diameter, while the other curves have been interpolated on the basis of a straight line relation between the area of cross-section of a wire and the maximum value of K_R , thus determining the curves for Nos. 4 to 14 B. W. G. wires.

Fig. 7 shows a set of (K_R , I) curves taken at various cycles on a steel rail weighing 100.8 lb. per yd. and having a cross section of 10.067 square inches and a specific resistance of 18,720 abohms. They seem

rather irregular and no definite relation exists between the frequency f and K_R maximum, due probably to the peculiar form of cross-section which causes μ to behave inconsistently at different cycles.

Fig. 8 illustrates the results of a series of tests on steel wire ropes of 171,000 lb. per sq. in. ultimate tensile strength and a specific resistance of 20,500 abohms per cm. cube.

The figure contains "impedance-factor" curves or (K_L, I) curves where $K_L = \sqrt{R_{ac}^2 + L_{ac}^2 \omega^2} / R_{dc}$, that is the ratio of a.c. to d.c. impedance. These three sets of curves, although representing extremes of form and quality of conductors, all show the same characteristics and general trend of (μ, H) curves and exhibit valuable qualitative results. Due to their representing European practice they are perhaps of less quantitative value than is desired. However, by means of various field and laboratory tests shown in Kennelley's classic article on "Impedance" in 1893 and since, together with a comparative study of American and European irons and steels by means of curves, very reliable data have been herewith compiled, which will be found consistent and in accord with all published and some heretofore unpublished data.

Other experimental data are contained in Figs. 9 and 10, which are self explanatory.

Fig. 10, at 140 cycles, has been checked satisfactorily by methods outlined in the discussion following.

The Bureau has published a large amount of data from which the present writer has interpolated many nests of curves at various cycles which have been used as a general guide, but unfortunately the tests were made on ungalvanized wire, and so are of doubtful quantitative value.

CONCRETE VS. EARTH DITCHES WITH DROP CHECKS.

A comparison of cost of lined canals with earth canals controlled by drops for the conditions found in the system of the Imperial Water Company No. 3 is given in their printed report for 1915.

The original plan of construction for the distribution system of this company provided for concrete laterals the first mile of length out of the headings, where the slope has the excessive rate of fifty to sixty feet fall per mile. To October, 1915, four laterals had been constructed, in extent $4\frac{1}{2}$ miles, at an approximate cost as follows:

	Per lineal foot.	Per mile.
25 cubic-foot capacity.....	\$0.50	\$2,640.00
35 cubic-foot capacity.....	0.625	3,300.00
90 cubic-foot capacity.....	1.20	6,336.00

To a mile, nine to eleven drops ranging from two to five feet, depending upon the topography, are required. The average cost is \$60 per structure, or for ten, amounts to \$600, while the cost of excavation averages \$350 and rip-rapping \$100, amounting in total to \$1050 per mile. Comparing the above with the cost of concrete canals which amounts to some \$3000 for the same capacity ditch, the favor is toward the earth ditches with concrete drops.

Maintenance on the ditches will never be of serious moment for the grades are laid out to a fall that permits of a control of check and scour as desired, by the placing or removal of flash boards.

"COOKING BY WIRE" AT PORTLAND. BY GEORGE G. BOWEN.

(This live subject is handled in a live way, giving the results of successful experience in interesting the housewife in electric cooking. The author is assistant sales manager Northwestern Electric Company at Portland, Ore.—The Editor.)

Some little time ago we took four of the leading electric ranges and made a thorough test of each, so that we might find out the facts concerning each style ourselves. We cooked a number of meals on each range, carefully keeping the results of these tests, and after a thorough investigation, we found that these four ranges were all practical for the housewife and also durable, and that with the manufacturers co-operation we could show the consumer that the electric range is a success. We were surprised ourselves, to find that the electric range was so satisfactory, and some of our employes purchased electric ranges and installed them in their homes. We next investigated



"Cook by Wire" Store—Northwestern Electric Company, Portland.

the territory that we were serving to see if it would be profitable for us to go into the range business. After co-operating with the Hughes Electric Heating Company in a free cooking school which was conducted in one of the leading department stores of Portland, we found that a great deal of interest was shown in electric ranges, so we realized that it was up to the central station to put before the public this new electric appliance.

We realized that the public must be educated in the use of the electric range. While there were a few old type electric ranges in Portland, in most cases they were operated by domestics and the bills were extremely high. We established a rate whereby cooking would cost 3 cents per kw.-hr., and we believe today that this rate will not interfere in the sale of electric ranges.

We first installed several ranges in our general offices where we could demonstrate the electric range to our consumers. Finding that this did not prove satisfactory from a sales standpoint and that it did not add to the general appearance of the office, we decided to open up a store for the sale of electric ranges exclusively. This store is 150 feet from Washington street, the principal street in the city, and is 21x60 ft., finished in white enamel throughout. The

rear of the store is made to represent a modern kitchen, with inlaid linoleum on the floor, imitation tile on the three walls, kitchen cabinet, ice box, electric water heater, tank and kitchen table, all white enameled. A meter that measures in watt hours is installed on the electric range used by the demonstrator. We also installed a number of comfortable white enameled chairs. We have an electric fan and indirect lighting fixtures all installed with the intention of giving the store a clean and sanitary appearance. Flush receptacles are installed just above the baseboards on the sides of the store so that all ranges on display in the store can be connected.

We named this store the "Cook by Wire" store as we found this the best name from a psychological standpoint. The total cost of equipping the "Cook by Wire" store, excluding the ranges was approximately \$500. The cost of operating and maintaining is \$500 per month, which includes the salaries of a salesman and demonstrator. We expect to have in the store continuous monthly campaigns, with free domestic science lectures by an experienced demonstrator. We will serve luncheons to the various women's clubs of the city, giving short talks on the advantages of cooking by wire. For the first thirty days the Hughes Electric Heating Company co-operated with us in having an exclusive Hughes Campaign, and furnished Mrs. L. M. Hayes, a home economist. We sent out invitations to our consumers to attend these lectures on home economics which were to be given each afternoon. The result of this 30 days' campaign was that we sold 64 Hughes electric ranges. At the close of this campaign, we were not able to get the immediate co-operation from other manufacturers so we called on all prospects obtained from this campaign, and since, we have sold 20 Westinghouse, 2 General Electric and 5 Hughes ranges, also 2 General Electric water heaters. Two apartment houses have been equipped to "cook by wire" exclusively. They are the "Imperial Arms" with 54 and the "Ellis" apartments with 20 ranges.

We are putting into effect for the next thirty days, extremely low prices and easy terms on all electric ranges. We will sell ranges at cost, dividing the payments into a period not to exceed 24 months and no payment to be less than \$3. We expect satisfactory results. In some cases electric ranges have been installed on 30 days' trial; also we will allow the water heaters to be operated two or three months in the summer and then disconnected the balance of the year.

This "Cook by Wire" store is for the sale of electric ranges exclusively and handles no other electric appliance of any kind. A central station opening up a store of this kind certainly proves to the public and the manufacturer, that we believe in the electric range and that we are determined to pioneer the range business.

We realize that we could sell a great many more ranges if we could do considerable more advertising, but the cost of the range is so high that if we added on even a small per cent of the cost of advertising, we find that it brings the cost of the range up so high that we could not sell them on reasonable terms. We are losing money on every range sold in order to introduce the range. If the manufacturers would co-operate

and do some national advertising it would help us out tremendously. We believe in the manufacturers creating a demand. We are ready to stand back of the ranges and close the sale, but interest must be aroused before we can start our sale, and the most effective way of getting interest aroused is by advertising. We find hearty co-operation among the local jobbers, most of them spend all their profits made on ranges in helping on various means of advertising and demonstrating. One of the local jobbers paid one-half of the expense of installing a large steel sign 7x17 ft. at a local apartment house where we are installing electric ranges.

Electrical merchants are not as much alive in their lines as the merchants in other lines and do not seem to appreciate the opportunities offered by the electric range.

Electrical contractors and dealers in any city can be a great help in the electric range business. A number of our prospects who decided to install an electric range, at the last minute said they had decided that they would not purchase a range now, as the electrical contractor who wired their house said that the electric range costs too much to operate and advised them not to purchase now, and that they would also like to cook with electricity but that it costs a great deal more than other means of cooking. I find that this is the sentiment of most all electrical men, and this, I believe, is a matter of ignorance on their part. I have one in my home and it costs me 25 cents or 50 cents more than gas, but its advantages are so much greater that I do not even consider that it cost me in the end a cent more than even gas at \$1 per 1000. I cook for six in my family and my bill averages \$3.50 per month.

When a person desires to buy an electric range or appliance, they generally ask advice of a friend who may be a contractor, dealer, jobber, manufacturer, meter reader, repair man, "wire fuzzer," or an employe of any branch of the electric business, whether this electric appliance he expects to buy is a practical thing for him to use. If this friend "knocks" it, he will not make the purchase, and all effort on the part of the salesman is lost in a second, when some other electrical man "knocks" the electric appliance. We believe in the electric range with our whole heart and soul. We believe it is practical, and we believe we will all be cooking by wire before long and paying 3 cents per kw.-hr, too.

When we first started in the electric range business we made a special canvass of electrical men and architects in the city in order to get them to "cook by wire," so they could recommend the electric range to their friends. We offered all kinds of inducements, giving them the range at cost, we paying for the installation and letting them pay for the range on their own terms at \$2 or \$3 per month if they so desired. We sold a half dozen or more and these people are good boosters for the electric range today.

If every electrical man, or even 10 per cent of the electrical men of the country, would cook by wire in their own homes, it would not be long until the other 90 per cent would also be cooking by wire.

The electric range business holds a tremendous future for the central station, manufacturer, jobber,

dealer and contractor. Let's all get together and boost with all our hearts. Buy a range for your own home, give it a trial, and you will see that we can boost the electric range game so that every central station, all contractors and dealers can sell the electric range, like the gas companies, furniture stores, hardware stores, department stores are selling gas, oil, wood and coal ranges today.

We can show the public that electric ranges are as practical as the electric iron, toaster, percolator and other appliances. Every electrical man has waited for the manufacturer to produce a satisfactory and practical electric range. It is here, let's get together and boost.

AN ELECTRIC APPLIANCE CAMPAIGN WHICH PRODUCED SEVEN-FOLD RETURNS.

Final report of the household appliance campaign conducted by the Northern Idaho & Montana Power Company shows a total of 1444 appliances sold, representing a connected load of 833 kilowatts. The campaign was under the direction of A. F. Douglas, new business manager for the Northern Idaho & Montana Power Company, in conjunction with Mr. Turnbull of the General Electric Company. A crew of four demonstrator-salesmen was employed throughout the campaign, starting at Newport, Washington, April 17 and finishing at Marshfield, Oregon, June 27.

The appliances were sold at a discount of 33 1/3 per cent if purchases were made at the time salesman called, each customer being given one chance to purchase any appliance desired.

The net expense of the campaign was \$776, representing the difference between actual traveling expenses and salaries of solicitors, and the sales profit. Estimated annual revenue from the appliances sold amounts to \$5,498.40, which is approximately seven times the net expense.

Prior to starting the campaign in any division a list of customers' cards was prepared. Notations were made on the cards by the solicitors as to the number of appliances each customer possessed, special data as to unusual installations, complaints, attitude toward the company, etc. Hand bills announcing that solicitors and demonstrators would call on each customer were distributed in each town a day or so prior to their visit.

Appliances were placed as follows:

Sandpoint, Idaho	229	Flat irons	612
Kalispell, Montana	272	Table stoves	698
Dallas, Oregon	191	Coffee percolators	87
Corvallis, Oregon	210	Twin glower (heaters) ..	11
Albany, Oregon	162	Heating pads	3
Springfield, Oregon	129	Water heaters	4
Marshfield, Oregon	251	Ranges	3
	1444	Chafing dishes	5
		Curling irons	2
		Toasters	19
			1444

Mr. Douglas gives four basic reasons for the success of the campaign, as follows:

1. Introducing the salesmen as demonstrators and stating in all advertising that these men would call at the home and demonstrate the various appliances. This was something new to the customer and gained an appreciative audience.

2. Demonstrators being equipped with good liter-

ature and a blue-print book covering all household electric appliances.

3. Demonstrators being fully advised before starting the work as to the proper application of each appliance, the mechanical structure of same, the rate of charge for current, and the cost of operating each appliance.

4. Demonstrators being supplied with customers' cards, and requiring a complete report on 35 customers each day from each salesman.

LETTERS TO THE EDITOR.

The Electrical Dealers' Problem.

Sir:—Anent M. L. Scobey's paper on "The Electrical Dealers' Problems," Mr. Max Loewenthal's discussion thereon, and your several editorials on the subject, I am reminded of the old story of the man who built a wall around himself to keep others out, but shut himself in.

All this talk about the sacred domain of the electrical dealer is tommy rot. The electric specialty shop can and should give better service to the buyer of electrical devices for the home than the general department store, the butcher, the baker, or the candle-stick maker. Goods well bought are half sold and an expert electrician knows more in a minute about the good and bad points of an electric iron or washing machine than any general buyer can expect to learn in a year. He should teach his salespeople what he knows himself, but above all else he should learn something about selling methods.

When it comes to selling goods over a counter a good merchant can give cards and spades to the average electrical dealer and still win out. What electrical dealer knows how to write an ad that will sell his stuff? Even if he knows how he lacks the guts to try it.

What would be the harm in having a dealers' section in the electrical contractors' and dealers' association where every hardware man, druggist and department store man would be welcome? The non-electrician could be taught what quality means in electrical apparatus. He would learn that selling shoddy stuff reacts on himself. The electrician could get points on counter selling, window dressing and advertising that would enable him to compete on even terms.

Any discrimination against non-electrical or non-association dealers is a dangerous game. The field for electrical sales during the next ten years is big enough and broad enough to let everybody in. Central stations will be far more likely to co-operate with electrical dealers if they stop this pin-headed policy of trying to hog everything for themselves.

In-breeding keeps the insane asylums full. There are more idiots among the royal families of Europe than in the peasant classes, simply because of this pernicious practice of trying to make a family affair out of the business of ruling the people.

In every business the most successful men are those with the widest knowledge of the general conditions pertaining to their particular specialty.

AMICUS CURIAE.

San Francisco, August 12, 1916.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

UNDERGROUND WATERS.

State and Federal Aid in Development of Underground Water.

Much interest has been aroused in the past five years in the investigations and development of underground water supplies in many of the western states. This has been due to a desire to secure both supplies for field irrigation and also in many cases to secure smaller supplies for domestic and small garden use in general dry farming areas.

California, which is the leading state in the extent of the use of underground water, has continued to develop its resources during this period. Owing to the extensive developments previously made the conditions and possibilities in the state were better understood and the work has been done by private incentive without much governmental assistance. In several of the other states the extent of the underground supplies are not known. This has resulted in a demand for state or federal aid in investigations both of the general occurrence and also in operating experimental plants.

In Utah, according to L. M. Winsor of the Agricultural Experiment Station, such investigations have been in progress for the 2½ years. There have been no special appropriations but the government and state agricultural college have furnished the supervision while the state conservation commission has supplied some funds for the operation of three pumping plants. The water developed is used for irrigation and careful records are kept as to results obtained by the application of water on the desert soils. These plants were installed on a co-operative basis, one deep well was sunk by the state land board, the other two were dug by farmers in the immediate vicinity. The pumping plants were furnished for use by one of the machinery companies, one of the railroads supplied transportation and seed and an oil company gave all fuel and lubricant used in the three plants. It is hoped that the work will grow in importance until the legislature will give it direct support. Much interest in underground water development has been aroused and the various machinery, houses and power companies are active in its encouragement.

In Kansas a state fund of \$40,000 is available for the installation of pumping plants. Before any of this fund can be expended in any county, however, it is necessary for the counties to donate the land for the plant. One gas engine and 3 wind mill plants have been installed. These are stated by Mr. H. B. Walker, state drainage and irrigation engineer, not to have been successful. This is not due entirely to the failure of pumping for irrigation in Kansas, but to ignorance in the construction of the plant. No additional plants are now being installed although a part of the state fund remains available. Assistance of an advisory nature is given by the state agricultural college to individuals or companies planning pumping plants. Where visits are made the services are given free, those ask-

ing for the assistance being required to pay the actual travelling expenses incurred in making the visit.

The Nevada legislature in 1915 provided for a department of engineering experimentation in connection with the agricultural experiment station. One of the duties of this department is to aid in the development of the underground waters of the state. An appropriation of \$5000 was made. It is provided in the law that anyone desiring expert advice as to location of wells, methods of developing underground water and character of machinery can apply to this department and if it is considered advisable by the head of the department, an examination can be made, the expenses to be paid from this fund. The commissioner of the Bureau of Industry, Agriculture and Irrigation has issued a bulletin on "Irrigation Pumping in Nevada," giving data on the location, construction and use of pumping plants.

Much attention has been given to pumping for irrigation in New Mexico and Arizona. In Arizona the legislature has appropriated \$2500 for 1915 and 1916 for investigations of underflow in the several counties of the state. The Agricultural Experiment Station has published a bulletin (No. 74) on "Oil Engines for Pump Irrigation and Cost of Pumping," which gives much information on the use of the lower grade oils. A bulletin has also been published on "The Ground Waters in the Rillito Valley."

In New Mexico an appropriation of \$1500 has been made for investigation and construction of wells on state lands, the cost of which are to be added to the land when sold. The Agricultural Experiment Station has also been active in investigations of the efficiency of centrifugal pumps, and has issued bulletins on these tests and on small plants.

In other states much interest has been taken in the development of ground water but has not reached the stage of definite state aid as yet. Much pumping for irrigation is now practiced in Washington, Idaho, Montana and other states, but consists largely of relatively large units pumping from surface supplies.

The United States Geological Survey has also been active in investigations of underground waters. Since 1903 there has been a separate division for underground waters. Ground water conditions in many localities have been studied and bulletins, included in the general series of water supply papers, published. These include some on parts of every western state, the total being over 50. In California alone 15 water supply papers dealing with ground waters in the more important portions of the state have been issued and others are being prepared. The list of publications of the U. S. Geological Survey issued from time to time gives the titles of all such bulletins. Besides the geology and occurrence of ground water much information regarding its use is included in some cases.

These various instances have been cited to show the very general and widespread interest in the subject. The investigation of general ground water conditions in a locality is beyond the means and knowledge

of those planning individual developments and is properly a subject for state or federal investigations. With the increasing difficulty of extending gravity supplies and the improvement in pumping equipment with its consequent reduction in the cost of pumping, continued development of ground waters is to be expected. In some localities where the occurrence and extent of ground water supplies are untested there may be a legitimate field for governmental aid in the actual operation of experimental plants. Where development has already taken place there is the same need of investigations of the extent of the supply as there is for the measurement of surface streams, although the conditions for estimating replenishment are not such as to permit of similar assurance in the accuracy of the results. It is now realized that the draft from ground water must be limited to the average rate of replenishment if the water table is to be maintained. Studies of such replenishment can best be made by other state or federal organizations as the results are of benefit to all.

Such studies for an area could well be repeated from time to time just as records of surface streams are continued from year to year. The effect of development and pumping on the water table furnishes the best basis for the study of the available supply. As the extent of such development changes, additional information becomes available from which the estimates of earlier years may be confirmed or corrected in the light of the later experience.

Storage and Underground Waters as an Aid to Gravity Flow.

The relative advantages of storage or pumping from wells for supplies to supplement direct gravity diversions from streams are discussed by Mr. W. H. Code in the recently issued volume on Waterways and Irrigation of the International Engineering Congress, 1915. The conditions in three valleys are cited.

In the Salt River Valley in 1900 the flow of the Salt River was unusually low and the loss of both crops and alfalfa stand was sufficient to fully arouse all classes. The resulting activity led to the construction of the Roosevelt dam to supply storage water. Investigations and test pumping plants were also installed to determine whether auxiliary supplies could be secured from the ground water. These were successful in developing water. Mr. Code is not aware of any other instances where so great an area of land has been threatened with a loss of crop while under it were located underground reservoirs of water sufficient to supply the adequate supplemental water supply needed.

Similar conditions on the Pima Indian Reservation in the Gila River Valley in 1902 led to the installation of the initial Sacaton pumping plant and the drilling of many test wells. The results were such that ten electrically-operated centrifugal pumping plants were installed to supplement the supply of the gravity canals. There has been more or less agitation concerning the construction of a storage reservoir on the Gila River, but such works require years for completion. In the meantime, great areas of land must remain in a desert condition; and this land could be cared

for if low concrete diversion dams were constructed across the river at points along the stream above lands previously demonstrated by actual experiment (as the Sacaton) to have underground reservoirs of water which could be drawn upon by pumping and thus reinforce the gravity supply of river flood waters. All such pumping works would be needed even in event storage reservoirs should be built at a later date. The territory proposed to be covered by this combined system should be tested thoroughly by drilling wells at different points and carrying on pumping tests at every well to determine the lift, quantity, character, and probable permanence of the underground supply. It is especially important that frequent analyses be made of the pumped water in order to determine its chemical constituents.

A third system on the lower Kings River in California is mentioned where the plan proposed is a gravity canal supplemented by pumping from deep wells. The above instances were cited to emphasize the importance of underground water development as an auxiliary supply to flood water irrigation. There are many streams in the West where irrigation has been limited to the area that can be irrigated successfully by the stream flow existing during the major portion of the irrigation season. The flood flows of these streams, however, may last for only two or three months of the irrigation period, and could be used most advantageously if pumping plants were installed on the lands bordering the stream, to supplement the gravity supply.

Comparative Costs of Deliveries.

A comparison of the cost of wood and concrete structures on the system of Imperial Water Company No. 3 is given in their recently issued report for 1915. The comparative costs of similar structures are given in the following table:

Structure.	Timber. 1 in. material, built in 1914.	Timber 2 in. material— improved design—1916.	Concrete
Deliveries	\$27.80		\$22
Checks	\$9.24	\$60	55
2-foot drops	145.57	..	45
3-foot drops	145.57	..	50
4-foot drops	155.37	..	60
5-foot drops	167.74	..	70
6-foot drops	183.34	..	80

It is stated that in a recent examination of some timber structures, built two and a half years ago, it was found that the wood at the ground line of many structures was in a badly rotted state. It is reasonable to believe that this life will be only 2, 3 or 4 years more and that replacement will then be required.

Duty of Water.

The variation in the quantity of water used on adjacent farms is brought out in an article by F. M. Cronholm before the Fifth Annual Conference of Operating Engineers held at Boise, Idaho, in February, 1916. The figures were secured from the hydrometric records on the Minidoka project. Under the pumping unit on similar soils, the quantity of water used on different farms varied between 80 and 163 per cent of the mean. In sections having lighter soils variations as high as 420 per cent were found in one section where the minimum use was 1.0 acre feet per acre and the maximum 5.2 acre feet.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

The best over-all efficiency obtainable in modern electric light generation from "crude petroleum to light" is about 1 per cent. Scientists tell us that the lightning bug generates his light at 98 per cent efficiency.

* * *

But as some "classic poet" has said:

"The lightning bug is brilliant,
But he hasn't any mind.
He blunders through existence
With his head lights on behind."

* * *

Moral: Keep your head-lights to the front.

* * *

Great business activity is expected in Germany after the war, so state the consular reports, and the question is being discussed in the Brunswick press as to the advantages of having special compartments in the cars of express trains for business men.

* * *

A municipal loan of the city of Rotterdam of \$2,400,000 at $4\frac{1}{2}$ per cent was recently oversubscribed twenty times. There is an abundance of money in the Netherlands.

* * *

The cost of the eight to ten million shells used at Verdun is estimated at \$300,000,000. Mining in France ought to be a productive industry after the war.

* * *

A Ford car operating in the Grand Valley for the U. S. Reclamation Service that travelled 14,200 miles, is said to have cost 15.6 cents per mile when all expenses of operation, repairs and depreciation are taken into account. What must be the bottom story for total costs of operation of the higher priced machines?

* * *

The United States Bureau of Fisheries hatched 128,700,000 lobsters in Maine and Massachusetts during the past year. We wonder who furnished the supply for the other states of the Union.

* * *

Statistics show that one may travel on electric cars in many American cities a total distance of fifteen miles for only five cents.

* * *

A nation-wide investigation has been started among electrical manufacturers and distributors covering accounting, cost-keeping and business methods of contractors, manufacturers, jobbers and dealers in order that there may be ascertained the exact cost of doing business in manufacturing, in jobbing and in retailing electrical goods.

* * *

An eastern electrically equipped cold storage plant recently saved \$25,000 worth of cold storage eggs due to a break down of a gas engine in a neighboring

cold storage plant. Better do it electrically in the future.

* * *

There are over thirty-two thousand students enrolled in engineering colleges throughout the United States.

* * *

Apply prussian blue to a light bulb as far down as is necessary to prevent direct glare of the light from shining in the eyes and it will be found much more comfortable for the workman.

* * *

Because Diesel engines frequently use pressures up to 700 or 800 lb. per square inch many scent danger in their use. The fact remains, however, that the engines suffer more from the increased temperatures resulting from such pressures than from the pressures themselves.

* * *

The longest high voltage, heavy current submarine cable in the world is that extending from the Lagan power house in Sweden to North Suland in Denmark, across the Oresund. This cable is 3.4 miles long, operates normally at 35,000 volts and was tested to 87,500 volts. During the first six months of operation only about 370 kw. has been transmitted as the war has delayed building up the load at Suland.

* * *

China imports nearly two hundred million gallons of kerosene a year. This is a half gallon per Chinaman. They must be hard drinkers.

* * *

The Canadian grain crop prospects for the season of 1916 indicate a crop around two hundred million bushels. Offers of transportation and good wages to 75,000 American workmen are being made to handle this bumper crop.

* * *

The development of two million horsepower of electric energy below the Niagara Falls without disturbing the Horseshoe and American Falls, and the expenditure of \$100,000,000 in the work, are proposed in a scheme submitted to the Dominion Government for approval.

* * *

The editor of Engineering and Contracting has figured the waste of the 3,000,000 horsepower at Niagara, left unharnessed for sight seeing purposes, costs the public \$150 per look, based on the number of visitors that annually view this nature wonder and the commercial value of the water passing over its undisturbed natural course.

* * *

Should we pause to divide the economic value of the Hetch Hetchy for water storage purposes by the number of visitors that have ever seen that national reserve, we could take the income and all retire for life.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Like a boil on the body politic, this week's crisis in the railway strike situation is merely a symptom of a more serious national disorder. Labor leaders are blamed for arbitrarily refusing to arbitrate, yet a properly constituted arbiter has not been provided. When mediation fails it is time for Congress to act.

That sporadic and endemic labor troubles have become epidemic is due to lack of means for adequate control. The machine needs new parts to perform new functions. Some regularly established system such as the municipal, state and federal courts, is necessary to insure justice to both sides in any dispute, as well as to protect the general public welfare. Whether these duties can best be undertaken by an augmented Department of Commerce and Labor or by an entirely new body is a question for early determination.

Meanwhile would not compromise be wise? Let each side yield a point until the merits of the entire matter can be decided. Should the employees' demands prove justifiable, then let the Interstate Commerce Commission make sufficient increase in passenger and freight rates to meet any deficit which the railways may face.

Labor difficulties, whether the national ones of the railways, the state troubles of the power companies, or the local disputes of culinary workers, require a broad-minded attitude for their solution. To engender class hatred and dynamite outrages is merely to add fuel to the fire. Labor and capital alike should be inspired by a common loyalty to the country, a willingness to arbitrate differences of opinion and a tolerance of opposing views.

The immediate answer to the present difficulties may work itself out temporarily even before these lines are read. But the lasting solution now seems to require a firm control of the situation in order to obviate the anarchy which inevitably ensues when constituted authority is ignored.

The liveliest topic of the hour among the various members of the electrical fraternity is "cooking by wire."

"Cooking By Wire"

The time has come when timid conservatism must be thrown aside and every effort made to educate the householder in the uses and economies of electric cooking. Too many of us are ourselves still in the doubting Thomas class to be of valuable assistance in boosting this campaign of education.

What really happens in a majority of cases in which a householder is approached on the subject of electric cooking is that the householder goes at once to an acquaintance who supposedly has some knowledge of electrical matters and asks his advice. If the electrical friend is ill-advised on recent advances in electric cooking appliances the sale is as a consequence not made. The electrical fraternity is itself vastly

ignorant of the recent improvements in electrical cooking devices and indeed ignorant of the economies and conveniences to be acquired under the low rates that have been established by the great power companies serving various communities of the West.

The remedy lies in first promoting a thorough and all sweeping campaign of education among the electrical men themselves. On another page of this issue is detailed an inspiring description of how opposition among electrical men has been overcome at Portland by an educational campaign among the contractors, architects, electricians, electrical employes and householders.

If the electrical fraternity is going to champion this new field of electrical profit let them all get abreast and primed to the muzzle with an enthusiasm based on sound facts, let them press forward in this productive and fruitful campaign of further utilization of electrical energy. Let none of us be like the captain who heroically issued the command, "men, strike for your country and for your home," and while they were striking for their country he struck for home.

Reorganization is today the rule rather than the exception with public utility corporations. Every locality can supply its example of an insolvent utility where reorganization appears to be the only remedy whereby the obligation to serve the public can be maintained. Whether this financial embarrassment be due to criminal inflation of securities or incompetent management of properties is, for the moment, not relevant. The ship has been wrecked and must be salvaged.

To the rescue come the wreckers, the reorganizers, men legitimately employed to save some value for the owners. They may bring about an equitable reorganization where the manifest rights of all are recognized and the present unfortunate security holders suffer a minimum for the mistakes and misdeeds of others. Or they may proceed ruthlessly, riding roughshod over prior rights and even conniving at the chance to legally plunder the victims of the wreck.

This last class is regrettably much in present vogue. All that is necessary is a coterie of conscienceless financiers, a cluster of callous lawyers, a complacent judge and a pack of parasites. As the courts of justice are unable to assume the management of all involved corporations, the outraged security-holders learn, too late, that they cannot get court redress until they have exhausted all the remedies within the corporation. The ordinary bondholder, in such cases, is defenseless. If he goes in, he is squeezed. If he stays out he is ignored. His money is treated as captured capital, to be so manipulated that he gets as little as is technically possible to grant. Meanwhile the man-vultures gorge themselves on the financial corpse.

Without positive proof susceptible of satisfactory citation in case of libel suit it is unwise to more than guardedly refer in an impersonal way to the pernicious practices of self-appointed reorganizing committees intoxicated by temporary access to other people's money. The case is purposely understated. The facts as locally developed would justify far stronger language.

In this is no sympathy for the investor who in ignorance or defiance of developed depravity in high places has put his or her money in jeopardy by foolishly "investing" in promises to pay. "Caveat emptor." Where the buyer did not beware, believing in the good faith and business honesty of those who were or might be manipulating the game, he should not whine or complain. It probably serves him right for such exercise of misplaced credulity.

The one purpose in thus noticing the predatory pack who chase crippled corporations is to give warning that their criminal proclivities are becoming thoroughly understood by their individual victims and that purely as a business proposition it were well to go slow. Confiscation of funds and retention of loot can not long continue. The impotence of the victims is vexatious—to them—and this vexation must react on the plunderers. Simply from the standpoint of personal gain, reckoning one year with another, these pirates would make more in the long run by leaving some of the swag. Some encouragement should be left to the disappearing species of money savers, otherwise the professional wolves may have to turn and rend each other,—a custom which is not considered good form in such financial circles.

To write further on this phase of reorganization would be unnecessary to those who can understand it—and useless to those who can not. Suffice it to suggest that incompetency of management and corruption of reorganization here plays each into the hand of the other.

Would that more of these "reorganizers" were honorable beyond the limits of an honesty sufficient to keep them out of jail! Would that they were gifted with imagination to see how finely and fairly their experienced brains might be used to conserve the captured capital for its owners and meanwhile turn an honest penny for themselves, keeping out of that twilight zone bounded by shrewd dealing on the one side and by plain swindling on the other! There do exist men of probity, honor and intelligence among the reorganizing committees who should rise to the opportunity to check this epidemic of criminal folly. These men of integrity can and should be the leaders in this period of reconstruction. They can be the means of saving the "reorganizer" from infamy. This is the chance that awaits the men that have been called in to preserve the United Railroads of San Francisco from the effects of public ill-will. These men undertake a difficult task, but as they have the respect and confidence of the community, they are likely to succeed in bringing order out of chaos.

PERSONALS

F. G. Baum, consulting engineer, has returned to San Francisco from the East.

E. A. Wilcox, electrical heating specialist, Great Western Power Company, is at Lake Tahoe.

T. E. Bibbins, president Pacific States Electric Company, has returned to San Francisco from Portland.

C. G. A. Baker, vice-president and treasurer Baker-Joslyn Company, has returned to San Francisco from Seattle.

J. H. Knost, salesman with El Paso office Westinghouse Electric & Manufacturing Company, is at San Francisco.

Fred Wilson, representative Standard Underground Cable Company, at Salt Lake City, has returned to Utah from a vacation trip to California.

H. Brewster Hall, Pacific Coast manager Pass & Seymour, Inc., has returned to San Francisco from an extended auto trip through Southern California.

Al. Younghoim of the Electric Railway & Mfrs. Supply Company, has returned to San Francisco from a week in Sonoma county, Cal.

Warren Murray, chief engineer Western Sugar Refining Company, has returned to San Francisco from a two months' eastern trip.

Leland S. Rosener, consulting electrical engineer, left San Francisco this week for the East in the interest of several clients.

C. G. Gauntlett, Pacific Coast manager Safety Insulated Wire & Cable Company, is spending his vacation in the Sierras.

M. F. Steel, salesman with Benjamin Electric Manufacturing Company, is in Arizona en route to the company's Chicago factory.

D. C. Pence, formerly connected with Julius Andre Sons Co., Milwaukee, has joined the sales forces of the Illinois Electric Company, Los Angeles.

W. M. Shepard, commercial manager California-Oregon Power Company, has returned to San Francisco from Los Angeles.

L. F. Harza, formerly consulting engineer at Portland, is now chief engineer for the Great Lakes Power Company, Sault Ste. Marie, Ontario, Canada, for whom he is installing a 20,000 h.p. development.

A. S. Kalenborn, electrical engineer, San Joaquin Light & Power Corporation, having finished the installation of a new steam plant at Betteravia, California, is spending a couple of weeks in the San Francisco bay region.

Franck Lane, a graduate with the first class in electrical engineering from the University of Santa Clara, has left San Francisco to take up the Westinghouse Electric & Manufacturing Company's student engineering course.

Reginald Duden, representing R. J. Davis, selling agent for Century fans and motors, is making a trip through Central California, and **Paul A. Shilton**, Los Angeles manager, has been making an extended trip through Southern California.

R. F. Behan, assistant manager San Francisco office Westinghouse Electric & Manufacturing Company, was instrumental in having the Shields Bill for waterpower development on navigable streams endorsed by the San Francisco Chamber of Commerce.

C. D. Marx, professor of civil engineering at Stanford University, is chairman of the waterpower committee which has just been appointed by the Commonwealth Club of San Francisco, and **H. E. Linden**, hydroelectric engineer, is

secretary. The other members of the committee are **F. G. Baum**, consulting engineer, **A. E. Chandler** and **W. R. Johnstone** of the State Water Commission; **Frank R. Devlin**, commissioner and **Paul A. Sinsheimer**, bond expert of the California Railroad Commission; **A. H. Halloran**, managing editor Journal of Electricity; **H. Clyde Harms**, attorney-at-law; **W. F. McClure**, state engineer, and **M. M. O'Shaughnessy**, city engineer at San Francisco.

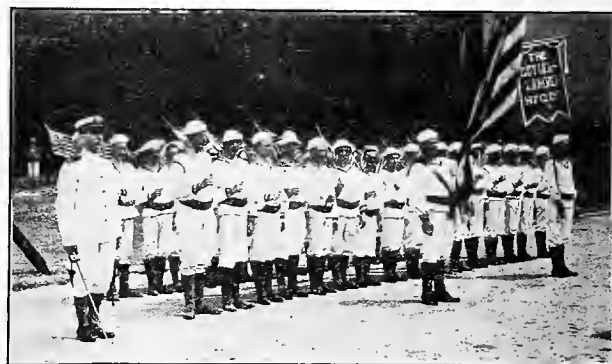
TRADE NOTES.

Montana Power Company, Holter Junction, Mont., have ordered from Westinghouse Electric & Manufacturing Company for their new Holter hydroelectric development (capacity 48,000 k.v.a., 3-phase, 60 cycle, 6600 volts), one 7 panel, one 6 panel, and three 5 panel switchboards, eleven type E-6, and seven 110,000 volt type GA oil circuit breakers.

The Westinghouse Lamp Company of New York has started a little publication entitled "How—I—did—it." Each month for the best story contributed on sales campaigns fifteen dollars will be given, ten dollars for the next best, and two dollars for all other stories accepted for publication. The matter is purely educational and in no way is the publication confined to the Westinghouse organization.

CUTLER-HAMMER EMPLOYEES IN MILWAUKEE PREPAREDNESS PARADE.

The well known spirit of the Cutler-Hammer organization was much in evidence July 15th when Milwaukee's Preparedness Parade took place. Miles of people, more than



Cutler-Hammer Marines in Preparedness Parade.

30,000 in all, marched in the parade. The Cutler-Hammer marchers were strung over a distance covering several city blocks, the number in line reaching about 1300. This large number or a total of 1600 employees is strong proof of the family spirit existing in the Cutler-Hammer ranks. "Each for all" is the C-H motto.

CALIFORNIA WATER COMMISSION NOTES.

M. F. Tarpey, **E. R. Reed**, **J. W. Beall** and **George E. Rice** of Fresno county and **Charles King** of Kings county, as trustees for an irrigation district or districts, have filed an application with the commission for permission to appropriate twenty thousand cubic feet per second of the waters of Kings River in Fresno county for the irrigation of lands in Fresno, Tulare and Kings counties. A proposed dam for storage of 600,000 acre feet of water is given as 300 ft. high, 1200 ft. long on top and 213 ft. on bottom, concrete construction, with waste-way over dam. Existing canals in the region now taking water from Kings River, are proposed to be used, as well as others to be constructed. The name of the district is to be The Pine Flat Reservoir District, and the application states that it is to be organized after the completion of surveys. Construction work is to be completed two

years after commencement and the water completely applied to the land two years after that. The total amount of land to be irrigated has an area of 1,200,000 acres.

The Western Development Company of San Francisco has applied to the commission for permission to appropriate $2\frac{1}{2}$ cubic feet per second of the waters of the South Branch of Oregon House Creek tributary to Dry Creek in Yuba county for irrigation purposes. By a dam of timber, rock and brush, applicants intend to divert the water to 90 acres of land at a cost of \$500. The works are to be known as the Meadow Lawn Stock Farm Ditch.

Emery Hunt of Oregon House, Yuba county, has applied to the commission for permission to appropriate three cubic feet of water per second from Oregon House Creek in that county for the purposes of irrigation. At a cost of \$400 for works, applicant intends to water 100 acres.

David S. Jones of Sweetwater, Mineral county, Nevada, has applied to the commission for permission to appropriate three cubic feet per second from Robinson Creek, tributary to E. Walker River in Mono county, for agricultural purposes.

Francis M. Carter, of Palliser, San Bernardino County, has applied to the commission for permission to appropriate the flood and surface waters of Swartout Canyon and Sheep Creek, in that county, for agricultural purposes to the extent of six cubic feet per second.

C. Roy Smith of Los Angeles has applied to the commission for permission to appropriate 25 cubic feet per second of a lagoon in Riverside county, tributary to the Colorado River. The main ditch of the proposed works is to be two miles long, fed by a pumping plant, the system to cost \$25,000, and to irrigate 3040 acres.

Earl L. Laib, John P. Burke of Los Angeles, Chas. Donlon, A. Camarillo, Jos. D. McGrath, John Lagomarsino and Jas. P. McLoughlin of Ventura, have applied to the commission for permission to appropriate thirty-one cubic feet per second of the waters of Duck Lake, Desolation Lake, Lake Muriel and unnamed lakes, tributary to the San Joaquin River in Fresno county. It is intended to make reservoirs of two of the lakes, storing 3800 acre feet of water and conveying same by means of tunnels and iron flume pipe to 2160 acres to be irrigated at an estimated cost of \$30,000.

The Loaldo Lands Company of Pasadena, has applied to the commission for permission to appropriate $7\frac{1}{2}$ second feet of Zaca Creek for irrigation. Complete surveys will give further information in regard to the works.

Louisa S. Paulson of Lewiston, Trinity County, has applied to the commission for permission to appropriate thirty cubic feet per second of Rush Creek, tributary to the Trinity River in that county for hydraulic mining purposes. The water will be conveyed from point of diversion to place of use by a pipe line 6.6 miles in length.

Edwin Heusser and Julius Bosshard of Pomona have applied to the commission for permission to appropriate three second feet of the waters of Cottonwood Creek in the Antelope Valley. The water at present loses itself in the gravels of the valley and the applicants intend to bring it on $57\frac{1}{2}$ acres for agricultural purposes, at an estimated cost of \$300.

The New England-California Corporation, by W. E. Vandiveer, superintendent, has applied to the commission for permission to appropriate 3.56 second feet of the waters of Stanislaus River for purposes of irrigation on its lands near Ripon, San Joaquin county. The water will be diverted from the river by means of a 25 h.p. electric motor, connected to an 8 in. pump of 1600 gallons per minute capacity. The estimated cost of the plant, and $2\frac{1}{4}$ miles of ditches is \$1200.

PROGRAM OF N. W. E. L. & P. A.

Wednesday, Sept. 6.

Morning Session, 10 o'clock.

Call to order; Address of Welcome, Mayor H. C. Gill; Response by N. W. Brockett, P. S. T. L. & P. Co.; Address of President E. G. Robinson.

Afternoon Session at 2 o'clock.

Paper: Application of Overhead Line Construction Rules of the Public Service Commissions of the Northwest, by M. T. Crawford, P. S. T. L. & P. Co.; Paper: Effect of Obsolescence of Equipment on the Cost of Service, by Leslie Craven, P. Ry. Lt. & P. Co.

Thursday, Sept. 7.

Morning Session at 9:30 o'clock.

Paper: The Employee as an Educator of the Public, by Arthur Gunn, W. V. G. & E. C., Wenatchee; Paper: Merchandising and Operating in Small Towns and Rural Communities, by Lewis McArthur, of the P. P. & L. Co., and W. F. Farquhar, W. W. P. Co.

Afternoon Session at 2 o'clock.

Electric Range Committee report, by W. R. Putnam, chairman. Special features of the report will be discussed by H. J. Gille, Advertising; M. C. Osborne, Rates; J. F. Derge and S. M. Kennedy, Merchandising; S. V. Walton and A. M. McMicken, Water Heating.

Friday, Sept. 8.

Morning session at 9:30 o'clock.

Paper: Standardization, by M. D. Cooper, Engineering Department, National Lamp Works, General Electric Company of Cleveland, Ohio; Round Table Conference conducted by President E. G. Robinson. Discussion will be conducted as follows: Commercial—All Questions—M. C. Osborne; Legal—All Questions—N. N. Brockett; Operation—Question 1, L. T. Merwin; Question 2, M. T. Crawford; Questions 3-6, J. B. Fiskin; Questions 5-6, J. C. Martin; Question 7, Arthur Gunn.

Afternoon Session at 2 o'clock.

Address, A Greater Jovianism, Arthur H. Halloran, Editor Journal of Electricity, Power & Gas, San Francisco; Paper: Co-operation Between Central Stations, Manufacturers, Jobbers, Contractors, Dealers, by W. L. Goodwin, vice-president Pacific States Electric Company, San Francisco, Cal.; executive session; election of officers; adjournment of business sessions.

BOOK REVIEW

Electric Heating. By E. A. Wilcox, E. E.; 5x8 in.; 292 pp.; replete with illustrations. Published by the Technical Publishing Company of San Francisco, and for sale by Technical Book Shop, San Francisco. Price \$2.50.

The utilization of electric energy for cooking purposes is the campaign of the hour among central station managers. Here is a book written by the electric heating specialist for the Great Western Power Company, which sets forth in a practical way the many uses to which electric heat may be applied, not only for electric cooking but also for the whole range of electric heat applications. The author discusses in a clear, concise manner the relative desirability of various kinds of heating loads from the central station point of view and also from that of the consumer. Relative operating costs of electric and fuel-heated apparatus are shown by tables and simple calculations. Hitherto little information of a practical nature has been available for equipping power salesmen with the necessary data to drive home his arguments on the relative advantages of electric heating in all its various applications. The book is timely and should secure an immediate and favorable recognition from all quarters where active campaigns are being put forth for new electric heating loads.



NEWS NOTES



INCORPORATIONS.

KINGMAN, ARIZ.—The Wallapai Lighting & Power Company has been incorporated with a capital of \$50,000. The officers are: Robert Roe, president; A. Fay, vice-president; A. L. Cox, secretary; R. C. Van Denberg, treasurer. The new company has taken over a small lighting plant installed by Mr. Roe.

SALEM, ORE.—With a capital of \$17,000,000, the Idaho Power Company of Augusta Maine, recently filed with Corporation Commissioner Schulderman its declaration of intention of engaging in business in the state. It was organized May 6, 1915. C. M. Hamilton and E. P. Summerson of New York are the president and secretary, and John A. Laing of Portland has been named general agent for the company in Oregon.

WEISER, IDAHO.—A union of the large hydroelectric interests of the southern and western part of the state from Blackfoot to Huntington has been made in a big merger, perfected in the organization of the Idaho Power Company with a capital of \$17,000,000. Merged into the Idaho Power Company are the Idaho-Oregon Light & Power Company, the Idaho Railway, Light & Power Company, the Great Shoshone & Twin Falls Water Power Company, the Idaho Power & Light Company, the Southern Idaho Water Power Company, with other small properties. F. F. Johnson of Boise is president of the new corporation and Wm. T. Wallace vice-president.

TRANSMISSION.

DUNSMUIR, CAL.—The California-Oregon Power Company is making arrangements to extend its service from Sisson to McCloud.

YOSEMITE, CAL.—About \$250,000 will be spent this year in Yosemite. The chief work will be the erection of a 750-horsepower electrical plant to cost \$100,000.

TAYLORSVILLE, CAL.—The Plumas Light & Power Company will extend its lines here from a tap on the Great Western Power Company's lines. The Plumas Company reports a 50 per cent gross increase in business during June, July and August.

REDDING, CAL.—The Green Horn Copper Company, controlled by San Francisco people, has arranged to have the mine machinery electrically operated, the power being drawn from the Crystal Creek plant near French Gulch. Construction of the new power line has begun.

TRANSPORTATION.

WHITTIER, CAL.—The Pacific Electric Railway Company has been granted a franchise to operate and maintain

GARDNERVILLE, NEV.—Fire has completely destroyed the electric power plant at the Fritz Dressler farm near Fairview. The electric dynamo, cream separators and dairy equipment were destroyed.

tracks on Philadelphia street and Greenleaf avenue.

HONOLULU, T. H.—Extension of the lines of the Honolulu Rapid Transit & Land Company to Fort Shafter will be made as soon as the plans are approved by the superintendent of public works. Double-tracking of King street and of Kalakana avenue will be started soon.

REDLANDS, CAL.—With the construction in the near future of a new bridge over Santa Ana River and the overhauling of the San Bernardino-Redlands line, Redlands will have through service over the Pacific Electric to Los Angeles. The proposed bridge, upon which construction work will start soon, will cost more than \$30,000.

LINDSAY, CAL.—The Visalia Electric Railroad will soon begin work at the El Mirador end of the proposed line and continue northward toward Lindsay and thence to the junction point with the Southern Pacific Railroad near the Randolph packing house. The route by which Lindsay will be entered is now under consideration.

LORDSBURG, N. M.—It is reported that the Carlisle Mining Company, under the ownership of New York and other eastern capitalists, is to construct an electric railroad from Duncan, Ariz., to their mines in Steeplerock district. An electric plant will be erected in the near future by the company, either at Duncan or somewhere on the San Francisco River, which flows through property of the company.

MISSOULA, MONT.—By the first of November, 1916, it is expected that steam engines will be superseded over the entire distance of 440 miles from Harlowton, Montana, to Avery, Idaho, on the transcontinental lines of the Chicago, Milwaukee & St. Paul. Electric trains are now running over a large part of this distance. The unique feature of the installation is that electric power is generated on the down grades thus eliminating difficulties incident to the use of air brakes in addition to a saving of a possible fifteen per cent in operating power.

EVERETT, WASH.—The report of Engineer Robert Hewes of Seattle, who was engaged by the city commissioners to investigate the power possibilities of the Sultana river, has been made to the commissioners. An enormous amount of power can be developed, the full amount will not be needed in the city for years, and the engineer has figured that the plant can be built a unit at a time. The plans drawn by the engineer contemplate the construction of but one large dam to store the water whereas previously drawn plans have included the erection of several dams. The engineer estimates the cost to develop 72,500 h.p. at \$6,127,000.

ILLUMINATION.

FRESNO, CAL.—At the next session of the supervisors bids will be received for lighting the court house park. The electrolier system will be similar to one installed by the city.

NEWPORT, CAL.—The state board of control has offered to buy three more of the city gas bonds at par. The city will sell the bonds and use the money for extension of gas mains.

SPOKANE, WASH.—The extension of the Riverside high power lighting system from Washington street to Cedar is being asked for in a petition by property owners. The cost of the improvement will be about \$60,000.

ENTERPRISE, ORE.—The Joseph Light & Power Company was purchased recently by the Enterprise Electric Company, thus completing the merger of all the electric plants in Wallowa county under one ownership and management.

VANCOUVER, B. C.—At a recent meeting of the civic fire and police committee the question of the installation of ornamental street lights past the Hudson's Bay stores on the one side of Georgia street, from Granville to Richards street, was taken into consideration.

EVERETT, WASH.—The Everett Gas Company has secured a contract with the Monroe Water Company to furnish electricity for pumping Monroe's water supply. The contract is for five years and will mean an increased revenue to the Everett company of approximately \$3000 annually.

SPOKANE, WASH.—C. A. Coffin, who procured the 35 year light and water franchise at Northport, has returned to this city to complete the purchase of equipment. Mr. Coffin

estimates the cost of installation to be about \$50,000. Construction will begin as soon as the equipment is obtained.

YUMA, ARIZ.—The Title Insurance & Trust Company of Los Angeles, Cal., as trustee, has taken possession of the properties of the Yuma Electric & Water Company, in accordance with a deed of trust. The same company has also taken possession of the properties of the Yuma Gas Company, in accordance with a deed of trust executed on the same date.

TELEPHONE AND TELEGRAPH.

MARSHFIELD, ORE.—A wireless station will probably be built at the site near Englewood during the fall.

MADERA, CAL.—Residents of Oakhurst are planning to extend their telephone line from Coarse Gold, the remaining 23 miles to Madera.

KINGMAN, ARIZ.—The supervisors of Mohave county have granted Anson H. Smith a franchise to operate telephone lines over county highways.

BRAWLEY, CAL.—A telephone line will be built this fall from Dixieland to Jacumba if plans now under way in Imperial and El Centro are carried out.

BLYTHE, CAL.—The Southern California Railroad Company has been granted a franchise to operate telephone and telegraph lines on Riverside county highways, the company being the highest bidder at \$75.

RICHMOND, CAL.—The Pacific States Telephone Company is spending \$5000 in extending its system, so as to accommodate the plant of the General Roofing Manufacturing Company and the territory adjacent.

VENICE, CAL.—Four new telephone lines are to be put in by the Home Telephone Company between Los Angeles and the Santa Monica bay district at a cost of \$10,000. Work on the new lines will probably be completed within two weeks.

CLOVIS, N. M.—Effort is being made to raise funds to install a phone line to terminate at Bellview, N. M., 40 miles from here. The plans provide for a main line direct to Bellview, from which spur lines will run, touching other points in the northern part of the county. The cost will be about \$50,000.

PORTLAND, ORE.—Francis H. Crosby of San Francisco, purchaser of the stocks and bonds of the Northwestern Long Distance Telephone & Telegraph Company, has been permitted in the Federal Court to extend his notes for \$240,000 to the American Telephone & Telegraph Company from January 1, 1917, to January 1, 1919, his petition for this privilege having been approved. Crosby based his petition on the delay of several matters connected with his taking over the properties due to litigation. He was permitted by the courts some time ago to take over the property for \$300,000, \$60,000 of which was in cash.

IRRIGATION.

WILLOWS, CAL.—A. Henning has applied for permission to take water out of the Sacramento River for irrigation purposes. He will erect a pumping plant to irrigate 200 acres.

OAKDALE, CAL.—The Oakdale Irrigation District is considering the damming of the Stanislaus River below the town of Melones and just above the Goodwin dam where the water of the two districts is now impounded.

SACRAMENTO, CAL.—The Consumers Irrigation District now in the process of organization will in all probability be extended on the north side of the Consumnes River to include a large area of rich land near Sheldon. The district will contain over 40,000 acres.

SACRAMENTO, CAL.—The validity of the Carmichael Irrigation District near Fair Oaks has been affirmed in a judgment rendered by Superior Judge Charles O. Busick. The same decision declares valid the \$90,000 bond issue for the district. Bids for the bonds will be received on August 23.

BANNING, CAL.—Final surveys have been made on lands of the Morengo Development Company in Morengo Valley. The company has diverted the course of Big Morengo Creek, where 200 inches of water are flowing at this season, and by tunneling and piping will bring it upon their lands.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company is constructing a brick garage and blacksmith shop adjacent to the electric plant to take care of all the company's motor vehicles. A new gas generator will also be erected, and a new gas purifier will be built in the near future.

PLACERVILLE, CAL.—The Chamber of Commerce, by unanimous vote, has placed itself on record as favoring the organization of an irrigation district embracing all irrigable land in the southwestern part of the county, between Pleasant Valley and the Sacramento county line. The project is known as the Diamond Ridge Water district.

OROVILLE, CAL.—Engineer Cauthard declares it will not be necessary for land owners in the low districts adjacent to Oroville to form water districts in order to obtain an abundance of water from the Western Canal Company. If the land owners promise a sufficient acreage to warrant the company bringing the water to a central point they will be supplied with water.

PLACERVILLE, CAL.—The property owners of the southwestern part of El Dorado county at a meeting at Rescue rejected the proposition to bond their land at \$40 an acre for the purpose of buying the Diamond Ridge Ditch Company's water system, buying the reservoir sites, building reservoirs and doing everything else that was necessary to establish the proposed water system.

SUSANVILLE, CAL.—The supervisors of Lassen county have called an election for September 7th for the purpose of determining whether or not the Honey Lake Valley Irrigation District shall be formed. The proposed district comprises approximately 30,000 acres, all within a radius of ten miles of Amedee. The estimated cost is \$956,000, and it is proposed to utilize the waters of Eagle Lake, Willow Creek, Susan River and many smaller streams.

SAN FRANCISCO, CAL.—The California Farm & Irrigation Company has plans under way for conveying water from the Colorado River in Riverside county to 60,000 acres, the works to be known as the Palo Verde Irrigation Canal. The water is to be diverted from the river by pumping plants, and the estimated cost of the project is given as \$2,300,000. The details of the proposition are as yet incomplete.

MEDFORD, ORE.—An election will soon be held for the establishment of another irrigation district in this valley, comprising 25,000 acres of the most fertile lands in the heart of the territory east of Bear Creek. It will cost the company about \$600,000 to supply the water. It is estimated that 90 per cent of the farmers in that district will vote for the establishment of the district.

BUTTER CREEK, ORE.—A petition calling for the formation of an irrigation district to water 7000 acres of land adjoining the proposed Teel irrigation district in eastern Oregon, near Echo, has been filed with the county court there, which will sit and consider the application on September 2. The estimated cost is not given, but it is intended to secure water from the proposed Teel project, most likely tapping the source of supply near the talked-of Lehman Springs reservoir. The Butter Creek work, though, would involve a complete lateral distributing system. The contract for both the work and the bonds for the Teel project, aggregating more than \$1,000,000, has been awarded to the Henry J. Kaiser Company, 830 Northwest Bank Building, this city, for which A. J. Welton is manager. While no definite date has been set, it is thought very likely that the contractors will have the job under way in the near future.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
10

Type "J" with Receptacle
for Shade Groove.

	List.	Sell.
J-11227-G, 1/2 in.	1.05	1.05
J-22227-G, 3/4 in.	1.20	1.20
J-33227-G, 1 in.	1.50	1.50

Type "JL" with Receptacle
for Shade Groove.

	List.	Sell.
J-11227-LG, 1/2 in.	1.30	1.30
J-22227-LG, 3/4 in.	1.40	1.40
J-33227-LG, 1 in.	1.50	1.50

Type "J" with Cord Rosette.

	List.	Sell.
J-11332, 1/2 in.	.90	.90
J-22332, 3/4 in.	1.05	1.05

Type "JL" with Cord
Rosette.

	List.	Sell.
J-11332-L, 1/2 in.	1.15	1.15
J-22332-L, 3/4 in.	1.25	1.25

Type "J" with Receptacle
Without Shade Groove.

	List.	Sell.
J-11227, 1/2 in.	1.00	1.00
J-22227, 3/4 in.	1.15	1.15

Type "JL" with Receptacle
Without Shade Groove.

	List.	Sell.
J-11227-L, 1/2 in.	1.25	1.25
J-22227-L, 3/4 in.	1.35	1.35

Type "J"—Casting Only.

	List.	Sell.
J-11	.60	.60
J-22	.75	.75
J-33	1.05	1.05

Type "JL"—Castings Only.

	List.	Sell.
J-112	.85	.85
J-222	.95	.95
J-332	1.05	1.05

Type "K" With Edison Receptacle
(Shade Holder Type).

	List.	Sell.
K-1127-G, 1/2 in.	.95	.95
K-2227-G, 3/4 in.	1.10	1.10
K-3227-G, 1 in.	1.40	1.40

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guaranteed by the publisher.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
9

CONDUIT FITTINGS.

Type "A."

Castings Only.

	List.	Sell.
A-1, 1/2 in.	.24	.25
A-2, 3/4 in.	.31	.35
A-3, 1 in.	.43	.45
A-4, 1 1/4 in.	.62	.65
A-5, 1 1/2 in.	.80	.80
A-6, 2 in.	1.66	1.66
A-7, 2 1/2 in.	4.95	4.95
A-8, 3 in.	5.45	5.45

Types "B" and "E."

	List.	Sell.
B-1, 1/2 in.	.29	.30
B-2, 3/4 in.	.36	.40
B-3, 1 in.	.50	.50
B-4, 1 1/4 in.	.80	.80
B-5, 1 1/2 in.	1.04	1.05
B-6, 2 in.	2.14	2.14

Types "C" and "D."

	List.	Sell.
C-1, 1/2 in.	.36	.40
C-2, 3/4 in.	.41	.45
C-3, 1 in.	.59	.60

Type "F."

	List.	Sell.
F-1, 1/2 in.	.50	.50
F-2, 3/4 in.	.65	.65
F-3, 1 in.	1.05	1.05
F-4, 1 1/4 in.	1.64	1.65
F-5, 1 1/2 in.	2.52	2.50
F-6, 2 in.	4.40	4.40
F-7, 2 1/2 in.	11.70	11.70
F-8, 3 in.	14.20	14.20

Type "G."

	List.	Sell.
G-1101, 1/2 in.	.65	.65
G-2102, 3/4 in.	.80	.80
G-3103, 1 in.	1.00	1.00

Type "H."

	List.	Sell.
H-110, 1/2 in.	.55	.55
H-210, 3/4 in.	.70	.70
H-310, 1 in.	.90	.90

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXVII NO. 9

SAN FRANCISCO, AUGUST 26, 1916

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THE FRUITAGE OF PRACTICAL CONSERVATION.

BY ROBERT SIBLEY.

AN AIR LIFT PUMPING PLANT AND THE DUAL USE OF WATER

BY S. T. HARDING.

PROPERTIES OF IRON AND STEEL WIRES AND CABLES.

BY CLEM A. COPELAND.

A MAMMOTH ELECTRIC BAKE OVEN.

BY BAYARD W. MENDENHALL.

APPLICATIONS OF ELECTRICITY TO MEDICINE.

BY DONALD K. LIPPINCOTT.

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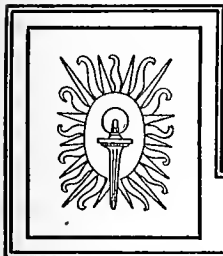
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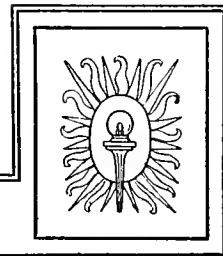
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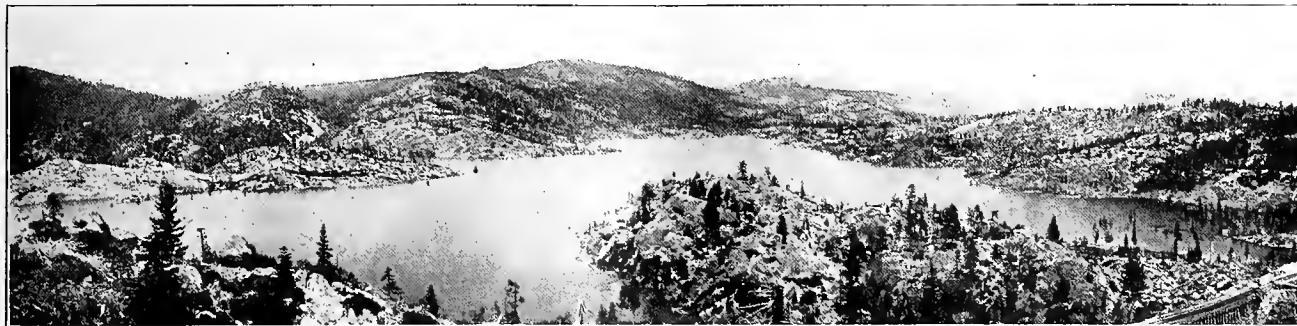


VOLUME XXXVII

SAN FRANCISCO, AUGUST 26, 1916

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Lake Spalding and Its Impounded Waters.

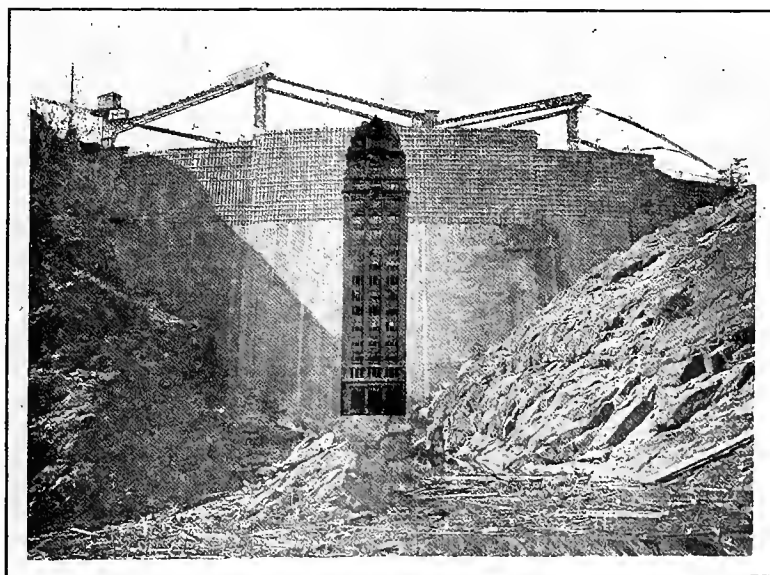
THE FRUITAGE OF PRACTICAL CONSERVATION

BY ROBERT SIBLEY.

During the past decade, while the public has noted with increasing satisfaction the growth of industrial and agricultural activity throughout the West, little actual credit has been given to one phase or side issue of hydroelectric development that year by year will extend its usefulness and indeed some day may be verified again the old proverb which says "The child has become the father of the man." Reference is made to the dual use of water made possible by the vast storage systems of Western hydroelectric companies.

There appeared recently in the daily papers of the West a brief announcement, for instance, that the Pacific Gas & Electric Company of Central California is to enlarge its Spalding dam by raising its present crest an additional 35 ft. By reference to the illustrations accompanying this

article, the reader will gain at once some conception as to what this means for conservation of waters throughout all posterity. And yet this is but one illustration of many that may be cited in Western undertakings. The Spalding dam is already 275 ft. in height, and its new height of 310 ft. will place it as a world record-breaker for depth of artificial waters impounded.



The Spalding Dam Under Construction.
(The giant height is strikingly shown by comparison with the Humboldt Savings Bank building, San Francisco.)

No complete data are available to set forth the vast reclamation of arid lands that are being made possible by such storage of waters under private enterprise, nevertheless in such instances as this the water is not only used many times over for power purposes, but finally it finds its resting place in the fertile soils of Western valleys under improved irrigation methods.

Of all the notable

conventions which met at the Panama-Pacific International Exposition, that of the Irrigation Congress will perhaps go down into history as best setting forth the progress of human endeavor in a manner that reaches the heart of man. Home building and creative productivity of the soil are after all the objects of human effort most treasured in the human breast.

Scarcely thirteen years have passed since the reclamation and irrigation legislation of Congress became a law. In this brief space of time over 9000 miles of canals have been dug; 26 miles of tunnels excavated; sufficient water stored in giant reservoirs to flood an area of 6,000,000 acres one foot in depth; 785 miles of wagon roads; 88 miles of railroads and 2500 miles of telephone lines have been built in isolated communities; and best of all 3,000,000 acres of land made available for settlement. During the year 1914, for instance, the value of crops raised on that portion of these lands now under cultivation amounted to \$16,500,000. The acreage actually cropped was 703,424. Hence we may easily compute the gigantic return in actual creative wealth that will eventually take place when these lands are settled to their ultimate capacity. In addition to these governmental activities, countless thousands of small reclamation projects have been put through by private enterprise throughout the Pacific Coast states.

Practically every mechanical and structural device known to modern invention has been made use of in conserving the waters and in putting the latent powers of these waters to their best use. Broadly speaking, the reclamation art consists in storing the vast flood waters of western streams so that they may be properly and scientifically applied in watering the arid lands tributary to them, thus making these lands productive for the wants of man. In certain instances the flood waters are so stored in favorable reservoirs that these gigantic bodies are harnessed to drive the industries of thriving communities before the water is later applied in irrigation. In still other communities some of the most fertile lands in the world are found along the bottoms of the great rivers of the West. As these rich lands are flooded during the rainy season, or during the period of melting snows in the high Sierras, the problem of reclamation in such instances becomes two-fold, namely the pumping of the water from the lands during certain seasons of the year and the pumping of the water back again upon the lands during the irrigation period.

In most of the larger reclamation projects of the West, the water is first stored in large natural reservoirs by the constructing of high dams. The water so conserved is then turned back into the stream during the dry period and taken out for irrigation purposes, oftentimes many miles below.

In some instances, however, a gravity system of flow is not possible. In such cases the water is pumped from the stream upon the lands desired to be irrigated.

This problem of pumping has developed into a gigantic industry in the great central and southern valleys of California and in the fruit producing sections of the Northwest. Recent years have divulged

the fact that many of the Western valleys are literally honey-combed with underground waters. This has made possible the individual electric pumps for thousands of ranches, since, in such an event, there is no cost of up-keep for irrigation canals and since low electric power rates are available; power companies have thus found a new and profitable source of power application. One company alone in central California furnishes over 60,000 electrical horsepower to small irrigators in the operation of pumps.

This combination of power development and water conservation is indeed developed to a high degree. In Southern California, for instance, the water conserved in the Bear Creek reservoirs located upon the head waters of the Santa Ana River passes through four successive power plants before it issues out into the open valley, exhausted in power possibilities but ready for application in irrigating the fertile orange groves dependent upon this stream for their very life energies.

Oftentimes the location of reservoirs is in such an out-of-the-way locality that the ingenuity of the constructing engineer is tested to the utmost in devising methods of transporting the machinery and materials of construction into the country. Thus the building of the road to the site of the Roosevelt Dam necessitated the blasting of a sheer cliff for long distances and proved one of the most complicated tasks in the construction of the Salt River project.

Nevertheless, the thousands of happy homes that now dot the plains, formerly available only for sage brush and the jack rabbit, attest the wonderful fruitage that is now observable on all sides, which points to the substantial success of these undertakings. Even the snow-decked electric trains that whiz out upon the thickly settled reclamation communities of the Northwest bear testimony to the content and prosperity of the settlers.

Thus it is, by these gigantic publicly built structures, coupled with innumerable smaller privately owned enterprises, that the "Great American Desert" of forty years ago has now become one of the richest portions of our country.

YOUR REAL BOSS IS THE CUSTOMER.

The superintendent of a big department store in Boston conducts a school of salesmanship in his establishment, and one of the first questions he puts to his class of beginners is: "Who is the boss?" After salesmen pupils have guessed every official about the establishment, the superintendent explains. "No, no, no; he is not the boss. The real boss in this store is the customer. It's the customer that you and I are here to please. It's the customer who pays your wages and mine. Now, if you are sitting behind your counter, doing nothing, and you see me coming, don't jump up; but if you see the customer—the boss—coming, jump! That always makes a deep impression. The lesson is a good one to memorize. It applies to the electrical business as well as any other.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

AN AIR LIFT PUMPING PLANT.

Water for the irrigation of lands in the vicinity of Pomona has been pumped from 18 wells by means of air lifts by the irrigation company of Pomona for the past 16 years. The following data regarding the plant and the operation results were secured from Mr. C. H. Hardon, the engineer of the company.

The equipment consists of a cross-compound condensing Corliss engine direct connected to duplex air compressors. Titus air lifts are used in the wells. Steam is generated by two 100 h.p. return tubular boilers using fuel oil. Including auxiliaries the steam consumption is about 22 pounds per h.p. hour when operating at $\frac{3}{4}$ load. The displacement of the compressor pistons when running at 100 revolutions per minute is 1200 cubic feet or 1080 cubic feet per minute at the average actual speed.

The wells vary from 200 to 970 ft. in depth. Seven inch casings are used on most of the wells, two, however, being 14 inch. The air lines into the wells are four inch pipe. The total capacity of the 18 wells is about 300 inches, although 360 inches have been secured for short periods. The depth to water in different years varies quite widely; in some years some of the wells have flowed. The water actually pumped varies with the demand, the average for 1915 was 258 miners' inches, or slightly over 5 second feet.

The regulation of the air pressure for each well is made at the outlet of the air pipe in the well by means of a long stemmed valve operating from the surface. These valve stems have 12 threads to the inch and are turned by a hand wheel having six spokes. This permits very close regulation, the pressure in each well being adjusted to the lift. This adjustment is made by the "feel" of the well, obtained by observation and experience of the operator. Variations in the pressure are shown in the character of the discharge of the well and adjustments made until the desired result is obtained. This adjustment has to be changed during the season due to variations in the height of the lift and the amount of water being pumped. A second valve at the surface is also provided so that a well can be shut off without changing the setting of the valve in the well.

Air is transmitted to the wells at a pressure of 60 to 65 pounds. Relatively large pipes are used and the line losses are small.

About 2500 acres are supplied by this system, part of the area being in the city of Pomona. Probably over one-half of the land irrigated is in citrus groves, the remainder consisting mainly of alfalfa, garden truck and small fruits.

Tests were made on this plant in 1905 by the U. S. Department of Agriculture, the results of which are given in Bulletin 181 of the office of Experiment Stations by J. N. Le Conte and C. E. Tait. These tests consisted of indicator card tests on the steam engine taken at half-hour intervals over a 6 hour period and a test on the air cylinders. It was found to be practically impossible to measure the lift directly on the 12

wells being pumped at the time of the test. The head was computed from the known air pressure at the wells and the length of the air pipe. The resulting head is considered liable to an error of about 10 per cent. The water pumped averaged 4.62 second feet or 231 inches. Based on the 133.7 total indicated horsepower of the engine the 22.0 useful water horsepower developed represents an efficiency of 16.5 per cent. The mechanical efficiency of the compressor was found to be 78 per cent. Based on the power output of the air cylinders the efficiency of the air lifts was 21.1 per cent. The plant of the Del Monte Irrigation Company was also tested at the same time and gave an efficiency of 17.9 per cent based on the indicated horsepower of the engine and 19.5 based on the indicated horsepower of the air cylinders, the mechanical efficiency of the compressors at this plant being 91.5 per cent. Tests of the Pomona company's plant made by Mr. Hardon when operating more nearly to capacity under favorable conditions, have given efficiencies of 28 to 30 per cent for the compressor and air lift.

The operation season extended from May to October. The cost of oil in 1915 was 75 cents per barrel.

The summary of the pumping operations for 1915 as furnished by Mr. Hardon is as follows:

Total hours run.....	2,798
Total gallons pumped.....	389,386.300
Average gallons per 24 hours.....	3,340.600
Total barrels oil used.....	2,141.5
Average barrels oil per 24 hours.....	18.36
Average gallons pumped per barrel oil.....	181,950
Average gallons pumped one foot per barrel oil.....	3,325
Average miners' inches pumped.....	258
Cost of fuel oil.....	\$1,611.30
Cost of engine oil.....	\$16.90
Cost of attendance.....	\$930.00
Cost of supplies, lights and waste.....	\$33.80
Total operation cost.....	\$2,592.00
Cost of operation per 60-in. head per hour.....	\$0.215
Cost of operation per inch per hour.....	.0036
Cost of operation of plant per hour.....	.926

The costs given are for operation only. The pumping plant is reported to have cost \$37,200. This includes the equipment, air lines and building but not the wells. This plant has been in use 16 years and is still giving good service. While somewhat improved machinery might be secured at present, the plant has a considerable remaining useful life and an estimated depreciation of 4 per cent per year would seem to be reasonable. If an interest rate of 6 per cent is assumed, the interest and depreciation will amount to \$3720 per year.

The quantity pumped in 1915 equals 1203 acre feet. The average lift is stated to be 60 ft. or possibly somewhat more as it can not be obtained definitely. On this basis the following unit costs can be obtained from the totals previously given:

Unit Cost of Pumping With Air Lift—Irrigation Company of Pomona, for 1915.

	Cost per acre foot raised one foot.	Cost per miners' inch per 24 hr. per foot of lift.
Cost of oil.....	\$0.2223	\$0.00089
Other operation expenses...	.0137	.00055
Interest and depreciation...	.050	.00200
Total	\$0.086	\$0.00344

The acre-feet raised 1 foot per barrel of oil used was 33.7 and the miners' inches per 24 hours raised 1 foot per barrel of oil was 842.

The other operation expenses in 1915 consisted almost entirely of attendance at the plant. No costs for maintenance and repairs were given for 1915. For average years some additional cost should be added to cover such items.

While the efficiency of these air lifts is low as compared with that which may be obtained with other types of pumps, they are well adapted for the conditions obtaining in this plant. For 18 wells scattered over a distance of a mile or more yielding an average of less than 20 inches per well, and having lifts varying from flowing to over 60 ft., the air lift has many advantages.

One advantage in the use of air lifts has been the low cost of maintenance of the pumping equipment and wells. For the 16 years of operation it is stated that the expenses directly in connection with the wells has not exceeded \$100.

DUAL USE OF STORED WATER.

The question as to whether a power company or an irrigation district can use the waters of a stream which it has stored, at its own expense, for more than one purpose, in other words, make a second use of the water, is a phase of the state's many complex problems which recently came before the California Water Commission in a joint application made by the Utica Mining Company and the Hobart Estate Company and the Oakdale Irrigation District of Stanislaus county. There is no Supreme Court adjudication on the question, but there appears on the other hand, to be no valid reason why the same individual, company or district may not generate power with water it has stored, and then use the same water for irrigation purposes. In other words, the potentiality of the water is not confined to any single use, but is of as many combined uses as can be made of it in compliance with the laws governing the appropriation and use of the public waters of the state. All the state asks is that the water be put to 'beneficial use.'

The Oakdale Irrigation District, in conjunction with its neighbor, the South San Joaquin Irrigation District, lays claim to all the hitherto unappropriated waters of the natural flow of the Stanislaus River. But the flood waters of the stream and its watershed, a vast quantity, go to waste annually. The only way to practically make use of this is by storage behind expensive dams. The Oakdale District comprises some 75,000 acres, only 15,000 of which are now irrigated. More water must be had, as the district develops. An agreement was entered into between the three parties to share the expense of the big proposed dam and reservoir at Spicers Meadows, the irrigationists to have the water after its use for generating power. The district was, however, not ready to proceed with the financial end, and fearing to lose the desired water, asked for a ruling by the water commission, to the effect that any persons storing water and using same for the development of power, be compelled to turn said water back into the stream, to be appropriated by persons below on whose lands it might be beneficially used.

A conference of the water commission members with the directors of the Oakdale District was held

a few days ago. It developed that while the Utica people might enter into such an agreement for the storage and appropriation of waters, as was proposed, there was, on the other hand nothing to prohibit a like agreement with others, in case the Oakdale District was not agreeable to proceed jointly with the Utica Company. There are other thousands of acres which can be watered from the Stanislaus stored waters and nothing would prevent the owners of the same from entering into an agreement with the power people, to the exclusion of the Oakdale District.

It has also developed that there seems to be no hindrance to the selling of stored waters to others for a second use if same are put to beneficial use, even though the buyers have not participated in the original expense of storage. Subsequent purchasers do participate in the expense later on, through the price they pay for the use of the water, based on the rates paid by them under the public utilities act. A case that has just come to hand, is that of the farmers of the Lincoln, Sheridan and Roseville Sections of Placer county, signing up contracts with the Pacific Gas & Electric Company, to purchase stored water, which will be primarily used for the generation of power and then turned into flumes and canals to be carried to the thirsty lands. In fact, the Oakdale District itself has already set a precedent, by an arrangement with the Sierra & San Francisco Power Company, for the use of water stored by that company and used first for power.

That an irrigation district would have the same right to use whatever of its water it desired for the generation of power first and irrigation afterward, does not seem to be disputed. Some time ago, a suggestion was seriously broached to one of the large irrigation districts of California that it utilize the fall of its water at the dam for the generation of electricity to be sold throughout the district for farm lighting and operation of farm machinery.

The conference between the water commission and the irrigation directors, proved to be in line with the policy of the commission to discuss freely and frankly with the people all matters arising over which there may be misunderstanding, thereby avoiding, where possible, interminable dispute and long and costly litigation. Following the meeting, it was agreed that the joint application of the Utica and Hobart people with the Oakdale Irrigation District should stand, that the irrigation district should participate in the storage scheme and share the storage expense as soon as the district was in shape to do so. Considerable delay will be occasioned in securing the storage concessions from the U. S. government. The commission will grant sufficient time and both interests hope to work out their joint proposition satisfactorily.

OIL PIPE LINES TO BE DOUBLED IN CAPACITY.

Improvements totaling \$1,500,000 on the Associated Pipe line between Bakersfield and Mendota, and installation of new equipment on 14 old stations between Mendota and San Francisco, will be completed late in August. The improvement service will double the capacity of the pipe lines.

PROPERTIES OF IRON AND STEEL WIRES AND CABLES.

BY CLEM A. COPELAND.

(This installment of Mr. Copeland's series of articles on skin effect shows the inter-relationship of tensile strength, size of wire and specific resistance for iron and steel wires and cables. These data, in connection with curves to be published later, give all the information necessary for calculating the impedance due to skin effect.—The Editor.)

The data and curves of Figs. 11 and 12 were prepared from standard tables, wherewith Table VI was compiled in a more consistent manner than catalogue data, so that the nests of curves would be consistent throughout. Table VI will be found to be slightly

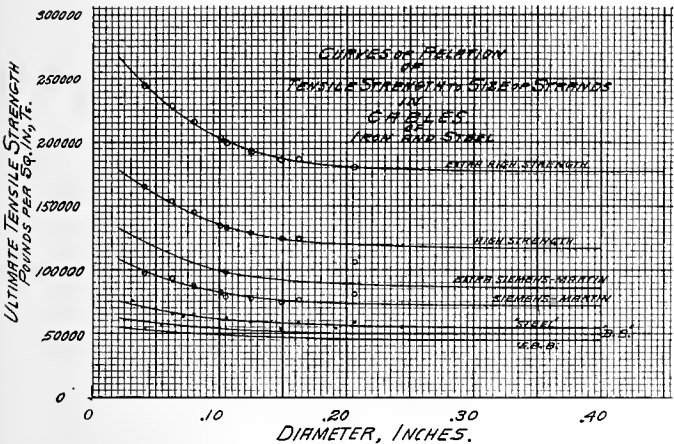


Fig. 11.

different from catalogue tables, although probably no more correct. Any company will be found ready however, to supply wires and cables of the qualities outlined in Table VI as readily and accurately as the qualities of those in their catalogues. In fact, the manufacturer, by the process of drawing and heat treatment or annealing together with chemical means, may produce any kind of characteristics within reasonable limits, varying the (μ , H,) and therefor the (K_R , I) curves at will. In fact, the same may be said of copper and aluminum conductors to a more limited extent, but the almost universal use of these metals as conductors has quite thoroughly standardized their properties, to a less extent, however, than is usually appreciated, as variations of from 5% to 7% in resistance to d.c. currents from the standard tables are often found in the field.

Table VI will be found to differ considerably as regards d.c. resistances from J. A. Roebling's Sons Co.'s handbook of 1897 and 1900, which engineers have used for several years, although the data contained therein seems to follow present practice as closely as more recent tables or Table VI.

Iron and steel wires are much less standard than copper in their qualities and variations of 10% from any of the above mentioned tables and the curves of this paper may be occasionally expected. On the other hand, considering the variations in diameter, weight, tensile strength and resistance of iron wires of the same trade name measured in the field, the writer has been surprised to find how consistently the finally derived results agree with practice when these variations are taken into consideration. For instance, a so-called E.B.B. conductor actually measured in the

field and found to have a d.c. resistance half way between "E.B.B." and "B.B." material as regards resistance will be found to have (K_R , I) and (K_L , I) curves about half way between the corresponding curves of the two materials. This relation seems to be established within reasonable accuracy. The specific resistances ρ in absolms or C. G. S. units of resistance per centimeter cube used in compiling Table VI are the following:

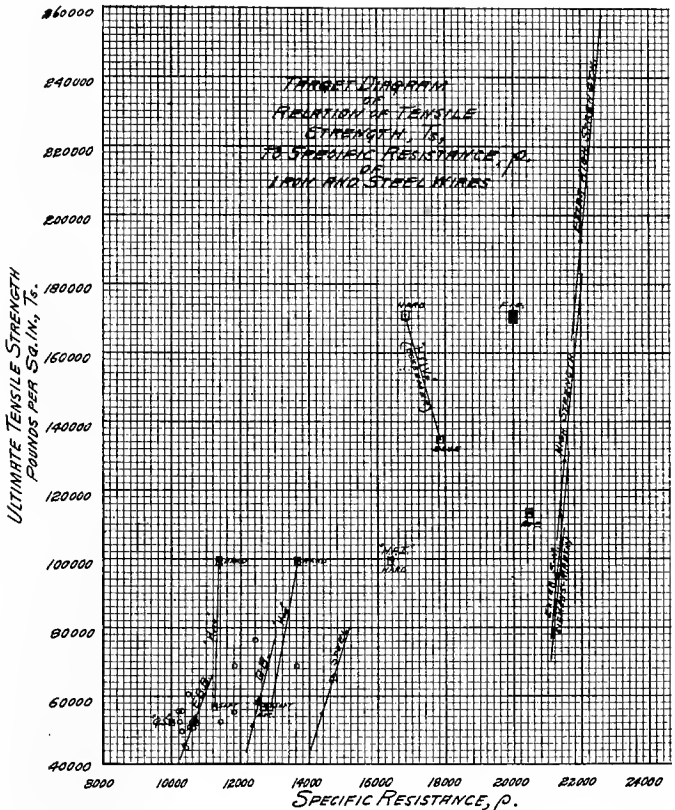


Fig. 12.

For Single Wire Conductors.						
"EBB" (Telephone) Iron.	"BB" (Telephone) Iron.	"Guy" Cable Steel.	Siemens Martin Steel.	Extra Siemens- Martin Steel.	High Strength (Crucible) Steel.	Extra High Strength (Plow) Steel.
10350	12310	14320	21150	21280	21500	22000
For 7, 19, 37, 61 Wire Conductors.						
10510	12415	14600	21255	21367	21650	22215

The latter are assumed to have a higher resistance due to drawing to accurate size and due to the stranding process, as shown in Fig. 11. The resistance R_{dc} per 1000 ft. in ohms is given by $4.724 \rho / 10^9 A$, where A is the area in sq. in. The following stranding factors are used in Table VI. Area of cross-section of conductor = number of strands \times area of each strand for calculating tensile strengths.

Weight of stranded cables equals—

- 7.0586 \times weight of each strand, for 7 strand cable.
- 19.3818 \times weight of each strand, for 19 strand cable.
- 37.867 \times weight of each strand, for 37 strand cable.
- 62.513 \times weight of each strand, for 61 strand cable.

The d.c. resistance of stranded cables is taken as 1/7, 1/19, 1/37 and 1/61 of the resistance of a single strand with 1% added in each case as a stranding factor.

In order to show the variations of products found in the open market, some examples of actual measurements are given.

TABLE VI.

Nominal Diameter of Conductor.				Actual Diameter of Conductor.	Area.		Weight per 1000 ft.	Ultimate Tensile Strength.										Resistance per 1000 Ft.					
								Pounds										At 20° C or 59° F.					
Fractional	Decimal	Number of Wires per Conductor.	Size of Wires	Of Each Wire.	Of Conductor.	Of Each Wire.	Of Conductor.	Pounds	EBB (Telephone) Iron.	BB (Telephone) Iron.	Steel (Telephone)	Siemens-Martin Steel.	Extra Siemens-Martin Steel.	High Strength Steel.	Extra High Strength Steel.	EBB (Telephone) Iron.	BB (Telephone) Iron.	Steel (Telephone)	Siemens-Martin Steel.	Extra Siemens-Martin Steel.	High Strength Steel.	Extra High Strength Steel.	
29/64	.45312	1 0000	B.W.G.	.454	Same	206116	.161883	Same	549.8	7375	8270	8915	11600	14000	18990	28700	.3023	.3597	.4185	.6180	.6220	.6280	.6435
		1 000	"	.425	"	180625	.141863	"	481.8	6455	7240	7805	10170	12270	16630	25150	.3450	.4105	.4770	.7050	.7125	.7170	.7340
		1 00	"	.380	"	144400	.113411	"	385.1	5163	5790	6245	8150	9825	13300	20120	.4310	.5130	.5965	.8820	.8875	.8960	.9175
11/32	.34395	1 0	"	.340	"	115600	.090792	"	308.3	4138	4634	4965	6515	7850	10635	16090	.5380	.6410	.7440	1.100	1.107	1.118	1.144
		1 1	"	.300	"	90000	.070686	"	240.0	3223	3609	3867	5075	6130	8310	12550	.6915	.8225	.9550	1.414	1.423	1.437	1.470
		1 2	"	.284	"	80656	.063347	"	215.1	2888	3234	3465	4500	5500	7400	11275	.7715	.9190	1.067	1.577	1.588	1.603	1.640
1/4	.25000	1 3	"	.259	"	67081	.052685	"	178.9	2400	2688	2880	3803	4580	6220	9430	.928	1.105	1.283	1.896	1.909	1.928	1.973
		1 4	"	.238	"	56644	.044488	"	151.1	2028	2271	2433	3240	3885	5275	7955	1.099	1.309	1.519	2.247	2.260	2.283	2.339
		1 5	"	.220	"	48400	.038013	"	129.1	1732	1940	2079	2797	3348	4550	6840	1.285	1.533	1.777	2.629	2.645	2.172	2.735
		1 6	"	.203	"	41209	.032365	"	109.9	1475	1652	1770	2387	2870	3885	5825	1.510	1.798	2.087	3.087	3.110	3.139	3.215
		1 7	"	.180	"	32400	.025447	"	86.42	1158	1296	1389	1894	2290	3083	4650	1.923	2.292	2.660	3.923	3.950	3.990	4.080
		1 8	"	.165	"	27225	.021382	"	72.61	975	1092	1170	1597	1934	2610	3940	2.280	2.720	3.165	4.680	4.710	4.670	4.870
		1 9	"	.148	"	21904	.017203	"	58.42	785	879	942	1305	1583	2137	3230	2.833	3.380	3.920	5.805	5.840	5.905	6.045
		1 10	"	.134	"	17956	.014103	"	47.89	645	722	774	1075	1319	1784	2690	3.453	4.112	4.790	7.090	7.140	7.205	7.370
1/8	.12500	1 11	"	.120	"	14400	.011310	"	38.41	515	577	618	895	1080	1465	2210	4.325	5.150	5.975	8.840	8.900	8.990	9.200
		1 12	"	.109	"	11881	.009331	"	31.69	425	476	510	756	905	1233	1857	5.235	6.240	7.250	10.700	10.77	10.88	11.25
		1 13	"	.095	"	9025	.007008	"	24.07	310	347	372	583	705	960	1437	7.180	8.550	9.930	14.250	14.35	14.49	14.83
		1 14	"	.083	"	6889	.005411	"	18.37	247	277	297	465	566	767	1147	9.000	10.72	12.43	18.470	18.59	18.77	19.20
		1 15	"	.072	"	5184	.004072	"	13.83	185	207	222	362	440	600	897	12.04	14.33	16.64	24.53	24.70	24.93	25.52
1/16	.06250	1 16	"	.065	"	4225	.003318	"	11.27	152	171	183	300	368	498	744	14.59	17.38	20.15	30.13	30.33	30.61	31.33
		1 17	"	.058	"	3364	.002642	"	8.972	120	135	145	244	302	407	608	18.50	22.00	25.60	37.80	38.03	38.40	39.35
		1 18	"	.049	"	2401	.001866	"	6.404	85	95	103	179	220	297	444	26.20	31.20	36.25	53.50	53.90	54.40	55.70
		1 19	"	.042	"	1764	.001385	"	4.705	63	71	76	136	169	227	338	35.30	42.00	48.80	72.10	72.55	73.30	75.00
		1 20	"	.035	"	1225	.0009621	"	3.267	44	49	53	98	120	163	241	50.80	60.50	70.33	103.7	104.4	105.5	108.0
1/32	.03125	1 21	"	.032	"	1024	.0008042	"	2.731	37	41	44	83	101	137	205	60.90	72.50	84.25	124.2	125.0	126.4	129.3
		1 22	"	.028	"	784	.0006158	"	2.091	28	31	34	65	79	106	158	79.50	94.70	109.9	162.1	163.4	165.0	168.8
1	1.00000	7 00	St.W.G.	.3310	.9930	.....	.086049	.602343	2080	27100	29800	32800	43200	52100	70550	106800	.0833	.0984	.1156	.1684	.1690	.1714	.1763
7/8	.87500	7 0	St.W.G.	.3065	.9195	.....	.073782	.516474	1780	23350	25700	28280	37100	44800	60725	91850	.0972	.1147	.1349	.1963	.1973	.1998	.2053
3/4	.75000	7 3	St.W.G.	.2437	.7311	.....	.046645	.326515	1126	14830	16630	17940	23660	28550	38700	58200	.1536	.1815	.2133	.3108	.3120	.3163	.3252
5/8	.62500	7 5	St.W.G.	.2070	.6210	.....	.033654	.235578	815	10770	12070	13200	17200	20780	28200	42300	.2129	.2518	.2958	.4310	.4330	.4385	.4510
9/16	.56250	7 6	St.W.G.	.1920	.5760	.....	.028953	.202671	700	9300	10420	11390	14900	18120	24330	36800	.2500	.2925	.3440	.5010	.5030	.5100	.5240
1/2	.50000	7 8	St.W.G.	.1620	.4860	.....	.020612	.144284	498	6245	7150	8240	10820	13100	176800	26640	.3480	.4110	.4830	.7030	.7070	.7165	.7360
7/16	.43750	7 9	St.W.G.	.1483	.4449	.....	.017273	.120911	418	5380	6020	7105	9160	11200	149900	226800	.4155	.4910	.5775	.8400	.8400	.8560	.8800
3/8	.37500	7 ..	.....	.1250	.3750	.....	.012272	.085904	294	3860	4400	5063	6700	8120	11000	16625	.5845	.6900	.8120	1.180	1.187	1.203	1.237
5/16	.31250	7 12	St.W.G.	.1055	.3165	.....	.0087417	.061192	211	2828	3165	3681	4965	6000	8135	12220	.8090	.9555	1.123	1.635	1.642	1.666	1.710
9/32	.28125	7 10	B. & S.	.1019	.3057	.....	.0081553	.057087	195	2665	3022	3478	4675	5645	7685	11540	.8800	1.039	1.222	1.777	1.786	1.810	1.870
1/4	.25000	7 14	St.W.G.	.0800	.2400	.....	.0050266	.035186	121	1714	1934	2232	3045	3693	5030	7550	1.427	1.685	1.982	2.885	2.900	2.940	3.018
7/32	.21875	7 15	St.W.G.	.0720	.2160	.....	.0040715	.028501	98	1418	1574	1852	2515	3080	4185	6250	1.762	2.080	2.448	3.563	3.580	3.630	3.725
3/16	.18750	7 16	St.W.G.	.0625	.1875	.....	.0030680	.021476	74	1094	1223	1422	1957	2397	3270	4860	2.340	2.762	3.250	4.725	4.750	4.820	4.945
5/32	.15625	7 17	St.W.G.	.0540	.1620	.....	.0022902	.016031	55	835	923	1085	1507	1840	2510	3745	3.130	3.700	4.350	6.330	6.362	6.450	6.625
1/8	.12500	7 19	St.W.G.	.0410	.1230	.....	.0013203	.009242	32	499	554	647	913	1117	1524	2267	5.440	6.430	7.555	10.99	11.03	11.19	11.49
3/32	.09375	7 21	St.W.G.	.0317	.0951	.....	.00078924	.005247	19	289	326	378	537	661	895	1335	9.575	11.30	13.28	19.33	19.43	19.70	20.22
1	1.00000	19 5	St.W.G.	.2070	1.0350	.....	.033654	.639416	2218	29250	32800	35800	46600	56400	76500	114700	.0786	.0928	.1089	.1587	.1593	.1616	.1660
7/8	.87500	19 5	B. & S.G.	.18190	.9095	.....	.025987	.493753	1710	22750	24800	28120	36530	44450	59400	89850*	.1015	.1200	.1411	.2053	.2063	.2093	.2150
3/4	.75000	19 8	St.W.G.	.1620	.8100	.....	.020612	.391628	1357	18100	20250	22320	29370	35530	48000	72250	.1282	.1514	.1780	.2592	.2603	.2642	.2713
5/8	.62500	19 8	B. & S.G.	.1285	.6425	.....																

I.

Communicated to the writer by U. S. Bureau of Standards. Mean specific resistances of a number of samples actually measured by Bureau at 25° C.

Quality.	E.B.B.	B.B	Steel.	Siemens-Martin Steel.
Absohms, per cm. cube.....	10700	12200	13400	18300

Another test exhibits the following data:

Maker.	Size B.W.G.	Area, Cir. Mils.	Absohms at 68° F.	Lb. per sq. in. to break.
U	6	41200	13600	68800
U	9	22250	12400	76100
U	14	7100	11800	55400
V	6	40800	11800	68800
V	9	22000	10300	55800
V	14	6890	10600	50400
W	6	41210	10200	52200
W	9	22200	10300	49700
W	14	6720	10400	44700
X	6	42020	10200	55900
X	9	21900	10700	52300
X	14	6725	10500	50400
Y	6	41500	10500	60500
Y	9	22200	11400	52300

The above appear in Fig. 12 in target form as circles. In the same figure are also plotted as heavy dots data supplied by The American Steel & Wire Company, while the triangular points appear in Roebbling's handbook. Boxed points are for German wires at 15° C., manufactured by Felton & Guillaume Carlswerk, while the double boxed point is connected with Fig. 8.

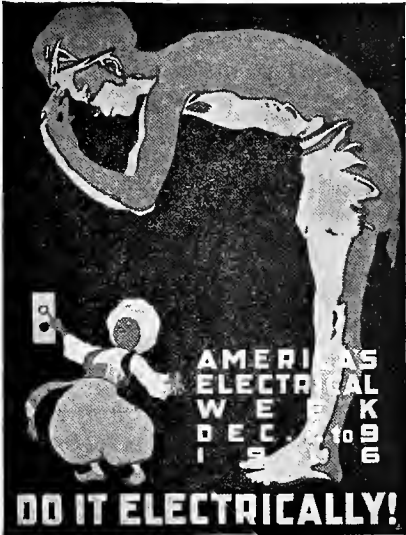
II.

A. S. & W. Co.....	4	56500	10690	E.B.B.
A. S. & W. Co.....	8	27100	10560	E.B.B.
A. S. & W. Co.....	10	17790	10820	E.B.B.
A. S. & W. Co.....	5	50000	13530	Steel
A. S. & W. Co.....	8	26800	13130	Steel
A. S. & W. Co.....	10	17956	13390	Steel

Other examples are given in Figs. 7, 8, 9 and 10.
(To be continued.)

SAN FRANCISCO BOY WINS POSTER CONTEST FOR AMERICA'S ELECTRICAL WEEK

The winning poster might well be entitled "Aladdin; Symbol of Service."



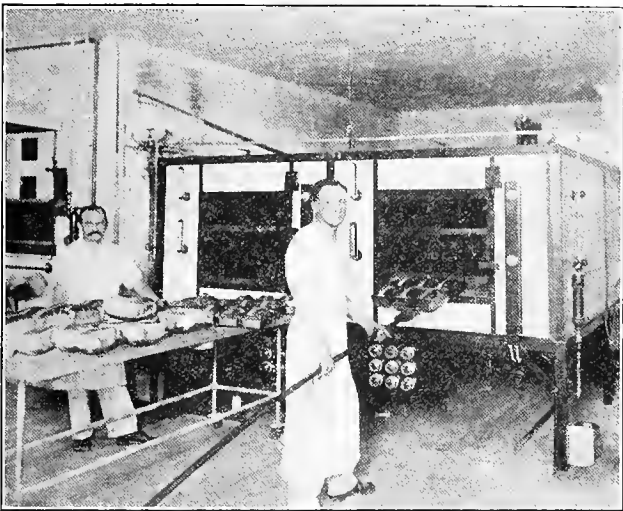
The Modern Aladdin and the Electric Button.

This design will be used throughout the campaign, millions of poster stamps, window and car cards, lithographs, bill posters, in newspapers, magazines, etc. It will be reproduced at least 200,000,000 times. Harold von Schmidt, a San Francisco boy, is the winner of the contest.

A MAMMOTH ELECTRIC BAKE OVEN.

BY BAYARD W. MENDENHALL.

So far as is known the first brand of bread to be put on the market which will be extensively advertised as being baked electrically has made its appearance in Salt Lake City. The New Vienna Baking Company of that city announced this new product during the week of August 7th to 12th while the convention of the National Association of Master Bakers was in session in that city. "Butter Krust," the trade name adopted, is baked exclusively in a mammoth Hughes



The Largest Electric Bake Oven in Existence.

electric bake oven installed by this progressive baking company. This company does an exclusive wholesale business, their entire product being sold through retail dealers.

The announcement made by Mr. Martinov, manager of the baking company, during the convention, will do much to stimulate interest in electric bake ovens all over the United States. A full page advertisement in the Salt Lake City newspapers while the Bakers' Convention was in session attracted much attention and practically every baker in attendance at one time or another visited this new installation. Mr. Martinov has a thoroughly modern bakery throughout including individually motor driven mixers, dividers, rounders and electrically heated wrapping and sealing machines. While his "Butter-Krust" bread was first announced during the convention week it sprang into instant popularity.

This Hughes oven is the largest electric oven yet installed and is their standard No. 415. The main body of the oven is 4 ft. high, 10 ft. wide and 12 ft. deep. It rests on an angle iron frame 27 in. high. It is divided into four chambers, each 56 in. by 34 in. by 16 in. high, which provides a baking surface of 208 square ft. The oven has a capacity of 836 twelve ounce loaves or 456 twenty-five ounce loaves of bread. The oven is divided in the center by a partition with two baking compartments on each side, one above the other. All compartments have 1¾ in. tile floor. The customary steam connection is provided for each. Each half of the oven has three heating units. One in the top of the upper compartment; one in the top of the lower compartment; and one directly under the floor of the bottom compartment. With this arrangement, heat

is provided for the top and bottom of each baking chamber. Each compartment has a mercury thermometer and inside lights.

The heating units are made up of resistance wire wound on insulated rods. These rods are mounted in an angle iron frame which may be slipped in and out of the oven for inspection and repairs. Each unit is divided into three sections, and each section has three heats controlled by three heat switches which are located near the center of the oven in front and within easy reach of the operator. This arrangement gives great flexibility and enables the baker to produce a uniform temperature throughout the entire baking surface of the oven. The doors through which the oven is filled are of the balanced type and are easily opened by the baker with the oven peel.

Galvanized iron is used for the outer cover of the oven with a white enamel front. The inside of the wall is of black iron covered with rust resisting black enamel.

The oven is wired to receive 220-volt 2-phase service. It has a maximum demand of 75 kilowatts and averages 48 per cent of its maximum demand on sixteen hours' baking per day and 55 per cent on eight hours' baking per day. It requires forty-five minutes to load the oven, bake the bread and take it out, using three-quarter pound loaves. On this schedule 25,000 three-quarter pound loaves could be baked in twenty-four hours continuous baking.

The product is admitted by all bakers to be superior to that produced by the old style ovens.

One great advantage of the electric heat lies in the fact that it is possible to maintain practically a uniform temperature in the oven through the entire period of baking, while with the brick oven the temperature gradually reduces and the time for baking is extended making it difficult to produce a uniform product.

A talk with the manager and head baker brings out the fact that they are very enthusiastic over electric baking. While they state that the bare cost for electricity is some higher than the cost of coal that when one considers the many advantages of the electric oven, not the least of which is the entire absence of dirt, dust, and smoke which inevitably go with the old brick oven and the saving in space, the higher cost for fuel is more than offset. While it is a little too early to say it definitely, it is believed by them that the value of the "baked electrically" feature of their product for advertising purposes will also go far to offset the somewhat increased cost of operation.

The oven is manufactured by the Hughes Electric Heating Company of Chicago. It was sold for the Utah Power & Light Company by Mr. George W. Cole, special salesman, assisted by H. P. Munger, western sales manager of the Hughes Company. The installation was made under the direction of Harry McClelland, one of the Hughes bake oven specialists, formerly with the Utah Power & Light Company.

The advertising campaign bringing out this new product was conducted for the Vienna Baking Company by Mr. R. J. Nafe of the Schulze Advertising Service of Chicago. Mr. Nafe succeeded in getting the various companies interested in the success of this new product to co-operate in two full paged advertisements in the newspapers announcing its inauguration.

MODERN APPLICATIONS OF ELECTRICITY TO MEDICINE.

BY DONALD K. LIPPINCOTT.

(Description and discussion is herein given regarding methods of obtaining high frequency current for x-ray tubes as well as current for fulgeration and other approved electro-medical practices. The author is associated with the Ricber Laboratories at San Francisco.—The Editor.)

To the average electrical man the term medical electricity probably brings vague recollections of electric belt advertisements. It is for him and not for the specialist that this review of the modern uses of electricity in medicine is written.

The ever widening field of the x-ray makes this the most important application of electricity to medicine. Used at first for the obvious purpose of localizing fractures, modern technique has made it available for diagnosing lesions of the stomach, intestines, kidneys, lungs and brain, while modern dentistry would be almost helpless without it.

There are four types of apparatus used for supplying the high tension current necessary for exciting x-ray tubes. The static machine was the first of these to be developed. Its advantages were that it gave a high potential, uniform current, and was therefore, "easy on tubes." Machines were made with twenty-four or more plates, 2 to 4 ft. in diameter, and were driven by hand or by belt from a motor. A few are still to be found in some of the older offices, but their low efficiency, high cost, the small total power available from even the largest sizes, and their maddening habit of refusing to work on damp days have made them practically obsolete.

Almost simultaneously with the static machine the induction coil was developed for this work, and for many years has been the favorite with the greater number of Roentgenologists. The ordinary type uses 110 or 220 volt d.c. on the primary side, with an input of 1 to 2 kw. Where direct current is not available a chemical rectifier is often used, or else power is taken from a small motor-generator set.

A mercury turbine interrupter, motor driven, with a rotating mercury jet playing on alternate conducting and insulating segments, is used in some outfits to break the current, while an electrolytic interrupter is supplied with others. But mercury, covered with kerosene to keep it from oxidizing, will emulsify and refuse to carry current, and electrolytic interrupters will sulk if too much platinum point is exposed, or too little, if the electrolyte is of the wrong density, or for no known reason, so the wise doctor usually had both types with a selector switch—and no sane man would guarantee him against trouble even then.

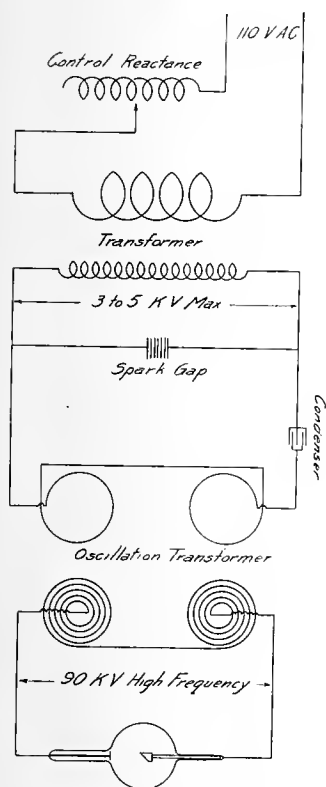
Control of tube voltage and current, mutually interdependent in this type of apparatus, is given by a multipoint rheostat, and, in some cases, by varying the number of primary turns on the coil.

Such an apparatus will give a secondary voltage of from 70 to 120 kilovolts maximum, and may supply as high as 30 milliamperes through the tube, though 15 milliamperes is a more usual figure. The lower voltage supplied on the "make" than the "break" of the primary circuit is relied upon to prevent "inverse," as current passing through the tube in the wrong direction is called. On account of the initial break-

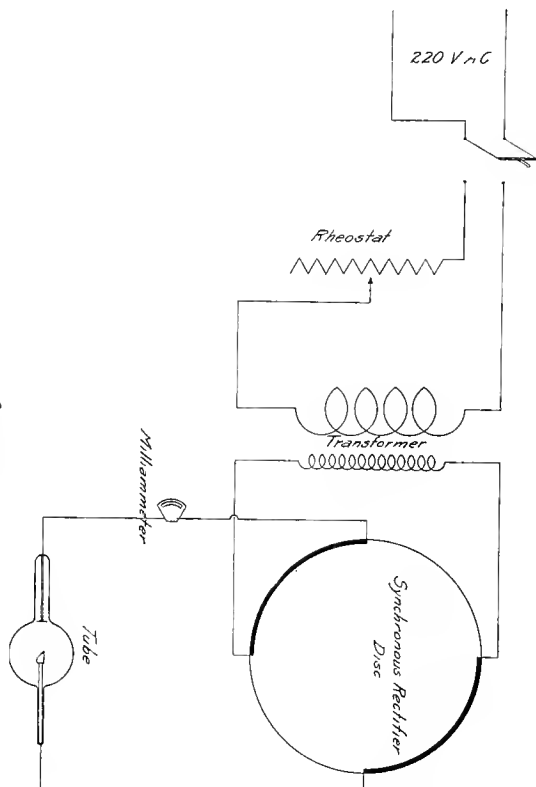
down voltage of the tube—from 10 to 30 kilovolts—this is usually effective, but sometimes other devices are necessary, in which case series spark gaps or valve tubes are used.

Where no great power is necessary, a coil will give good service, but for lung or stomach pictures, where involuntary movements will cause blurring unless the picture is practically instantaneous, the only type of apparatus which will give results is the so called "interrupterless transformer." Although there are many of these on the market, and although they vary greatly as to results obtainable, they differ little in the essentials.

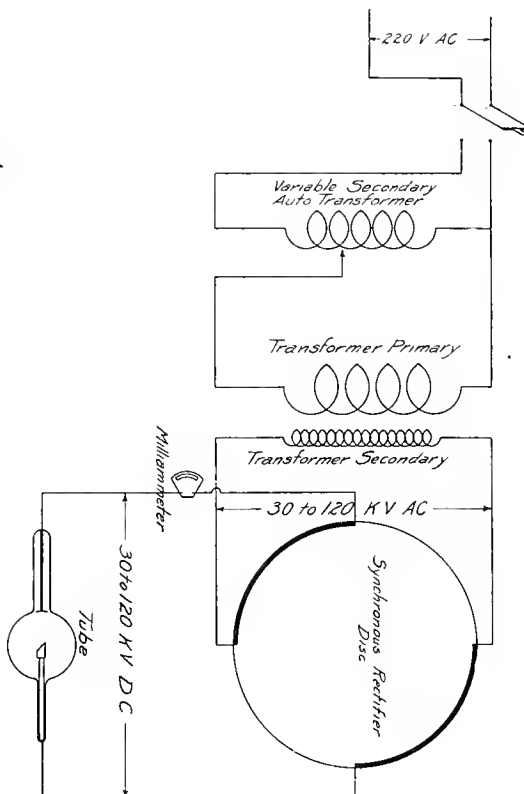
the penetration of the rays depends entirely upon the tube voltage. With impedance control of voltage, which is furnished with the great majority of the apparatus on the market, consistent results can be obtained only as long as the tube resistance remains constant, and fairly high. When the tube warms up with use and demands a larger current, the impedance drop across the apparatus consumes a greater proportion of the total voltage, until the part backed up by the tube may become so small that the rays will not even penetrate flesh, and the shadow of a hand on the photographic plate will show a uniform density and fail to reveal the bones at all.



High Frequency X-Ray Generator.



High Impedance Control Interruptless Transformer.



Low Impedance Control Interruptless Transformer.

Power is drawn from a.c. mains to supply a transformer, which would be rated by the A. I. E. E. at from 3 to 15 k.v.a., and for which the makers proudly claim from 5 to 25 k.v.a. output. A commutating switch, driven from the same mains by a synchronous motor, rectifies the high tension secondary current, supplying a pulsating uni-directional current to the tube.

Most makers claim from 150 to 200 kilovolts as their maximum secondary voltage. The results of a large number of sphere gap tests of different makes have failed to show over 90 kilovolts, although the flash over voltage of the rectifier, and not the transformer maximum, has usually proved to be the limiting factor.

The best outfits vary their voltage by an auto-transformer, in the low tension side, with multiple taps. With this arrangement, the tube voltage regulation from zero to full load—which may be as high as three hundred milliamperes with this type of apparatus—is very good. This is an important point, as

The same considerations show why the doctor demands leads much heavier than his total load would seem to warrant. To him voltage regulation is all important, and line drop must be reduced to a minimum.

The high frequency type of x-ray generator is used principally in portable apparatus. A small transformer giving a secondary voltage of about 3000 supplies an oscillating circuit which includes the primary of an oscillation transformer, which steps the voltage up to about 90 kilovolts. With this apparatus, a special form of tube is used, which shields the plate from rays generated by inverse current. These tubes also have certain valve tube characteristics, in that they show a lower resistance to direct than to inverse current.

Regulation is obtained by a reactance in the transformer circuit and by varying the spark gap in the oscillating circuit.

The big points in favor of this apparatus are its lightness and cheapness. A complete outfit, including tube, will weigh only from 60 to 75 lb. and cost less than \$200; hence the popularity of this type of device

with the general practitioner, 90 per cent of whose x-ray work it will handle. For anyone making a specialty of Roentgenology, however, the low power available makes it useless.

All of the types of apparatus mentioned are used for giving treatment for various diseases, as well as for taking pictures. Owing to the danger of serious results from over-exposure to the rays only the "interrupterless" type should be used, as with this type alone can the exposure be so metered as to make accurate results possible.

Leaving the x-ray and taking up the other uses of the electric current, the most important application is the surgical use of the high frequency spark in "fulgeration" or "dessication" as it is called.

At very high frequencies—500,000 per second or over—a current of over an ampere (.25 ampere will cause death at low frequencies), may be passed through the body without producing muscular constriction or any sensation other than one of warmth. This makes it possible to burn out tumors by sparking to them directly, using the body of the patient as a ground or return circuit. A wide range of ailments, from warts to inoperable cancer, are treated in this manner, non-malignant tumors of the bladder being the field where it has found especial usefulness.

The apparatus used is substantially the same as that used for generating high frequency current for x-ray use. The voltage required is much lower, however (10,000 volts maximum), and the circuits should be designed to give a much greater frequency than is usual for x-ray work. It is also important that the spark gap give a very steady discharge, as inequalities produce painful muscular contractions.

High frequency currents themselves are recommended for everything from diabetes to baldness, but the general opinion of the medical profession seems to be that such results as they may show are largely due to the psychological effect. Applied to the entire system they will produce a temporary reduction in blood pressure, which is sometimes desirable, but a Turkish bath will produce as lasting an effect more surely.

Direct current at a potential of from eight to one hundred volts is used for various purposes. As variations in the voltage may be very painful, dry or storage batteries are often used as the source of current. Another type of apparatus in general use taps off at different points along a resistance supplied by a 110 volt d.c. circuit. The current used is from three to fifteen milliamperes. The chief use of this "galvanic" current is in the removal of moles, warts or superfluous hair by electrolysis.

Slow sinusoidal current, at voltage up to about 100, are used for exercising atrophied or partially paralyzed muscles. They are produced by belt connected motor generator sets. The frequencies used are from one to fifteen per second, depending on the part of the body involved.

Even the "electro medical battery coil"—advertised in all mail order catalogs, and very similar to the one with which you shocked your admiring relatives when first you dabbled in electricity, has some use. In diagnosing certain diseases of the nervous system,

it is invaluable—the principle being that if one doesn't kick when jolted with it there is something very wrong. It is also used in the same manner as the sinusoidal generator.

In an article of this kind it is impossible to give all of the types of apparatus in use, or to more than touch upon a few of the uses of the types mentioned. Enough has been said to give some idea of the large medical field in which electricity finds rational employment—a field that is widening every day. The psychological factor, too, should not be underestimated. Medical application of electricity in any form is bound to impress upon the patient that something is being done for him. The treatment is harmless, and "faith cure" often works.

Of course there are, and probably always will be, quacks who operate in this field "for revenue only," but that should not prevent us from recognizing the earnest, scientific work of the pioneers who have given it its present standing.

No electro medical apparatus, with the possible exception of x-ray outfits of the induction coil or transformer classes, should make trouble for the central station man. Either of these types may be fruitful sources of surges and should never be installed without some form of line protection. Here the simplest thing seems to be the best. A high resistance graphite rod, with the middle grounded, is not only the cheapest but the most effective remedy.

Prophecy as to development of new electro-therapeutic uses can be nothing more than wild guesswork. Future x-ray progress is more clearly defined. Modern tubes are at best less than one-fifth of one per cent efficient. To bring this figure up, and to standardize equipment and units, is the work of the immediate future.

A HOME ELECTRICAL IN THE HOOD RIVER VALLEY.

R. E. Fewell, of the Hood River Gas & Electric Company, next week will complete one of the unique homes in Oregon. His new residence, an eight-room bungalow, is chimneyless. Mr. Fewell is a skilled electrician, and in every room he is installing electric radiators. Beneath the house, to furnish hot air to circulate between the double floors, will be a large electric furnace. The kitchen range will be an electric one. Electric motors will operate washing and ironing machines.

CALIFORNIA HEADS LIST IN PETROLEUM.

The quantity of petroleum marketed in the United States during the first half year of 1916 is estimated by John D. Northrop of the United States Geological Survey at 140,000,000 bbls. His estimate is moderate and his apportionment of the output among the major fields is as follows: Appalachian, 11,400,000 barrels; Lima-India, 1,800,000; Illinois, 7,900,000; Kansas and Oklahoma, 50,500,000; Northern and Central Texas, 4,200,000; Northwest Louisiana, 6,800,000; Gulf Coast, 11,400,000; Wyoming and Montana, 2,400,000; California, 43,500,000; miscellaneous (Colorado, Michigan, Missouri), 100,000; total, 140,000,000.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

The winning cover poster for America's Electrical Week is to be reproduced over 200,000,000 times during the big electrical campaign this fall. Even the ten million cannon shells fired at Verdun are not in the same class as this concentrated volley.

* * *

Gophers on the Klamath project, according to the June Reclamation Record, refused to eat the usual grain poisons, an effective method of killing them however was devised by the use of the exhaust fumes from automobiles. A rubber hose was attached to the exhaust pipe, the other end being placed in the gopher hole, earth being pressed around it to retain the fumes in the hole. This method was successful, and where the gopher holes were thick a large number could be treated in a short time.

* * *

The Council of the Institution of Electrical Engineers of Great Britain has adopted resolutions stating several measures which it advocates as a means of advancement for British engineering. It is in favor of a broader recognition of high technical attainments, and among the changes it advocates is that the use of the metric system be made compulsory after a reasonable period, and that during this period all trade catalogues makes use of both the British and metric systems.

* * *

The value of manufactured products in the United States was \$24,246,323,000 in 1914, and \$20,672,052,000 in 1909, the increase being \$3,574,271,000, or 17.3 per cent, according to figures compiled by the U. S. Bureau of Census.

* * *

The aggregate of the tolls collected from the ships passing through the Panama Canal during the past year is \$2,399,830.42, nearly eight hundred ocean going vessels having passed through. Due to the closure of the canal for six months the above represents about sixth months' business for the normal year.

* * *

The sundry civil act, approved July 1, 1916, appropriated \$80,000 for establishing a light and fog-signal station at Point Vicente, Cal. Point Vicente is the most prominent point on the California coast between Point Loma and Point Conception, a distance of 220 nautical miles. This light will serve the increased traffic due to the opening of the Panama Canal.

* * *

The Japanese government is fostering a scheme for small life insurance policies, the maximum amount of insurance on a person being one hundred twenty four dollars. No physical examination of the applicant is to be made, but if the insured dies within two years from the date of the insurance contract, from a cause other than "a natural calamity, or a contagious disease, such as cholera, smallpox, dysen-

tery, typhoid fever, typhus fever, scarlet fever, diphtheria, or plague," a portion of the amount insured may not be paid.

* * *

British efforts to increase trade with Russia after the war are taking the extremely practical shape of encouraging the study of the Russian language by young men training for commercial life. We of the Pacific Coast should follow this example and urge our young men to perfect themselves in Spanish.

* * *

The crude petroleum marketed in the United States in 1915 amounted to 281,104,104 barrels, valued at \$179,462,890, thus breaking all previous records.

* * *

The average price received at the well for crude petroleum during 1915 was 64 cents a barrel.

* * *

The gas industry has adopted the word "gastrone," meaning a lady who operates a gas range with such artistry that she satisfies the tastes of the gastronome, or the epicurean fond of good living.

* * *

What shall we call the lady who operates the modern electric range? An electrone, trone or drone? If by the last word we mean a "do-nothing" and yet "one who takes the honey," surely the operator of an electric range meets the requirements.

* * *

Did you ever stop to think that if the twenty million American families install electric ranges a sales campaign of a billion dollars will have been put over in this one branch of possible electric appliance installations?

* * *

And did you ever stop to think that such an installation would increase the central station power load by about three hundred millions of dollars a year?

* * *

The greatest telescope in the world, a 100-inch reflector, is soon to be completed upon Mt. Lowe in Southern California. Maybe we will yet see something live and interesting on Mars, who knows?

* * *

America's Electrical Week, December 2 to 9, will surpass all previous attempts. When you see a copy of the "Electrifier," and the "Exciter" soon to appear, you will at once double your former enthusiastic support.

* * *

Bolivia in South America is as big as Germany, Austria and England. Peru is as large as all the United States from Nova Scotia to Indiana, from Canada south to the gulf. Argentina equals all the United States west of Omaha. And Brazil is a United States with another Texas added.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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California has often set the precedent for the establishment of mining and water right customs throughout the various Western commonwealths. The latest precedent that has now been established is that relating to the dual use of water.

The Dual Use of Water

As is generally known stored waters may be put to three or more separate and distinct uses. For instance, the water may be used for power development and later used in the irrigation of arid lands or for domestic purposes of a municipality. As to whether a company derives the right to all three of these uses by simply developing the power, for instance, has long been a debatable question.

On another page of this issue may be found an interesting and important discussion of various phases of this problem by the California Water Commission. Undoubtedly all the rights that may accrue from stored waters should belong to the company or corporation that foots the bill for development, provided of course the water is put to a beneficial use and reasonable rates are granted for water purchasers on the part of others in which the district is located.

In the past the greatest injustice has come about in the dual uses of water from old mill rights that were established in the early days and later on abandoned.

In Montana, for instance on many streams mill rights were taken out and upon abandonment of the mill operations, the locators claimed this water for irrigation purposes of date of their original filing. Meanwhile agricultural interests began to flourish in various communities and appropriators for irrigation found themselves confronted with mill rights that had only been used as such in the early days, but subsequent to their appropriations the owners of the mill rights had attempted to divert the waters upon arid lands in the community and make their appropriations tally in date with that of the original filing.

Such practices as this wreaked much injustice upon legitimate settlers who had in a bona fide manner located upon their lands only later to find themselves confronted with costly litigation.

It would seem that immediate and positive rulings should be sought for and established at an early date throughout all our Western communities. And in cases where the law is not sufficient to properly make an adjudication, those interested in the stability of Western water rights should see to it that the proper laws are passed.

Now that the enthusiasm of preparedness parades has somewhat spent itself, it would seem right and proper to quietly analyze just for what purpose a gigantic preparedness propaganda has been undertaken throughout the nation from shore to shore.

True Preparedness

The question in its ultimate analysis will be seen to be fundamentally not one merely of patriotic fervor alone, but one that has at its foundation a reason which closely calls into question the ethical standard that this nation in its foreign commercial and engi-

neering activity may have had or may have in the future. Thus at once we are interested from the very nature of the question.

Let each ask himself the question "why prepare?" and the answer comes back that some nation may take the American nation unawares and enslave it commercially or otherwise. But why should some nation desire to do this? Because fundamentally it may bear a grievance against America.

Let us then see just what grievances foreign nations may bear against this country and apply the remedy. Although such a procedure may not safeguard America against predatory nations, yet in the course of international righteousness, such a course on our part would bring about true preparedness—a preparedness that adjusts grievances ahead of time on the principle that "a stitch in time saves nine."

When one travels through the far off Orient or to South American ports he is often caused to blush when there is related to him some act of questionable business practice that the so-called "yankee trader" has inflicted and is still inflicting in countless places among our foreign neighbors.

It is needless to list the case of antiquated agricultural implements shoveled off upon the unsuspecting Argentinian, or the inferior grade of machinery that has at times been unloaded upon the ignorant Chinese.

The question before us is that these abuses have been committed, one hears it on all sides in foreign ports.

It would seem, then, a splendid "true preparedness" measure on the part of the American government to appropriate a million or two along with the millions for guns and cannons now under way for the sole purpose of seeing to it through a Foreign Relations Commission that fair play is given our neighbors in every respect and that the good name of America be not besmirched by close-fisted, questionable practice on the part of a certain class of Americans dealing with our foreign neighbors.

Fully half of the electrical dealers' difficulty is due to his not knowing how to advertise. Limited demand, slow turnover, high overhead, department store competition—the things that keep him awake nights—can all be met by the right kind of advertising.

Advertising Arguments for the Dealer

Consider the problem of increasing the demand, to make prospective purchasers realize the disadvantage of trying to get along without electricity. This means the finding of new publics, the creation of business where none existed before. Here is advertising's first function, to eliminate limitation of demand by extending the sales field.

Weigh in mind the trouble caused by infrequent turnover, which is only another name for insufficient capital. Money tied up in a slowly moving stock is manifestly not available for carrying on other activities. In any retail business goods that do not turn over at least four times a year are parasites. Adver-

tising is a wonderful acceleration of frequency and turnover.

How to induce the overhead per unit sale is another problem solved by advertising. This overhead is largely caused by the high cost of selling, of distributing articles to the ultimate consumer. Advertising, universally acknowledged as the most economical method of distribution, is a potent factor in cutting the cost of selling.

Department store competition is an ever-present bug-a-boo to the electric specialty shop. The success of the modern department store is dependent upon its advertising. In fighting fire with fire, in emphasizing the value of expert service, lies the only recourse left to the electric shop. Let the small store's trade-mark center in service, in greater personal contact with the customer and its ultimate success is assured.

Advertising should not be confused with personal salesmanship. By bringing buyers to the store it allows the counter-salesman to close the sale. Using salesmen as advertisers is as wasteful as using an advertisement as a salesman. One supplements the other. Advertising repetition establishes a reputation for a commodity or a service. Salesmanship cashes in on that reputation.

Let the retailer remember that the same arguments that induced him to buy his goods will usually sell them to his customers, especially if his advertising sales arguments are charged with vitality and enthusiasm. Every advertisement should carry something of real news interest, an easy requirement with electricity today.

A good advertisement should appeal to the people to whom it is directed. It should be timely and pertinent. When written naturally so as to carry the individuality of the advertiser and when so specific as not to apply to any other advertiser it is most effective, especially when it gives an impression of authority and sincerity. If carried on consistently and persistently it cannot fail in its purpose of instilling confidence.

By this is meant not only newspaper advertising but also window displays, store cards, demonstrations, bill-boards, street car cards and mailed literature. In all these respects the dealers' helps supplied by manufacturers and jobbers are valuable if they do not subordinate the individuality of the dealer in emphasizing the product. Such material should tie in the store with the manufacturer's publicity, should emphasize the dealer's facilities and buying judgment and should lay stress on the superior service rendered by a specialty shop.

These suggestions require courage and capital, without both of which no man should embark as an electrical retailer. Bigger profits come only from bigger advertising, better salespeople, improved service and superior stock—none of which can be obtained by cutting down expenses in a futile attempt to get around the cause of diminishing returns. Thus, and thus only, will it be possible to speedily convert today's electrical luxury into tomorrow's electrical necessity.

PERSONALS

W. Brewster Hall, Pacific Coast manager Pass & Seymour, Inc., left for Solvay, N. Y., this week.

W. E. Eskew, manager Electra plant, Pacific Gas & Electric Company, was at San Francisco this week.

Walter G. Clark, consulting engineer of New York City, was at San Francisco during the first week in August.

H. R. Noack, Pierson, Roeding & Company, San Francisco, has returned from a vacation trip in the high Sierras.

T. H. Nelms, salesman, Pacific States Electric Company is making an extended trip through Northern California.

A. F. Holmes, purchasing agent Electric Appliance Company, is expected to return to San Francisco from Chicago this week.

Robert Tchumay, proprietor Visalia Electric Works, has returned to Visalia from an auto trip to the San Francisco bay region.

J. B. Beil, Pacific Coast manager of the Standard Underground Cable Company, has returned to San Francisco from Los Angeles.

Frank Somers, president California Association of Electrical Contractors and Dealers, was at San Francisco from San Jose this week.

W. W. Briggs, general sales agent Great Western Power Company, has returned to San Francisco from a two weeks' outing in Sonoma County.

C. R. Downs, manager of the Amador Electric Light & Power Company of Sutter Creek, Cal., was at San Francisco during the past week.

M. S. Orrick, Western Electric Company, has returned to San Francisco from a two weeks' automobile trip over the Tioga Road to Lake Tahoe.

G. B. Rosenblatt, engineer in charge mining division Westinghouse Electric & Manufacturing Company, has returned to Salt Lake City from California.

W. L. Goodwin, vice-president Pacific States Electric Company, is making an automobile trip through Yosemite and Lake Tahoe over the Tioga road.

S. J. Lisberger, superintendent of distribution for the Pacific Gas & Electric Company, has returned to San Francisco from his vacation at Lake Tahoe.

H. S. Batchelder, formerly in the electric sign business, has joined the Western States Gas & Electric Company at Stockton, Cal., as commercial manager.

Edgar A. Loew, who has been assistant professor of electrical engineering at the University of Washington, Seattle, has been promoted to an associate professorship.

Henry L. Doherty, president of Henry L. Doherty & Co., and president of the Society for Electrical Development, is a candidate for election as Jupiter of the Jovian Order at the annual congress at Indianapolis, October 18, 19 and 20.

James F. Kinder, western representative of the Wise-Harold Electric Company, of Canton, Ohio, manufacturers of the well known Ohio Vacuum Cleaner, visited San Francisco this week; making a trip over the entire territory on his way north.

Wm. Tardiff, salesman Electric Appliance Company, has returned to San Francisco from a two weeks' vacation in Lake County, California. Frank Mills of the company is renewing old acquaintances with the California-Oregon Power Company in Shasta County.

Frederick Bedell, professor of applied electricity at Cornell University, is at San Francisco, whence he will proceed to Seattle to attend the Pacific Coast convention of the Ameri-

can Institute of Electrical Engineers, where he is to present a paper on "Characteristics of Admittance Type of Wave Form Standards."

Tracy E. Bibbins, newly-elected president of the Pacific States Electric Company, has long been regarded as the dean of electrical supply men in the West. Ever since 1890, when he cut his eye-teeth as general factotum in a little supply house at Portland, he has been actively identified with every movement tending towards the betterment of the electrical supply business. During the early nineties he was storekeeper for the Edison General Electric Company at Portland, a consolidation of the Edison Manufacturing Company and other of the Edison companies which in turn took in the Northwest Electric Supply & Construction Company,



Tracy E. Bibbins, Newly Elected President of the Pacific States Electric Company.

of which S. Z. Mitchell, now president of the Electric Bond & Share Company, was then the head. With the amalgamation of the Thomson-Houston and other companies forming the General Electric Company, Mr. Bibbins came to San Francisco in 1895 as a clerk in the supply department under F. M. Ray. He was made supply manager when Mr. Ray resigned in 1901. At this time he was associated with others in starting the original electrical jobbers' organization which subsequently developed into the Pacific Coast Electrical Supply Jobbers' Association. In 1912 Mr. Bibbins was made local manager of the General Electric Company, which position he has filled to date. Those who have watched Mr. Bibbins' past activities cannot but conclude that in taking the helm for the Pacific States Electric Company he will make no change in the company's established policy of assisting in the upbuilding of the electrical business in the West by active sales and educational effort. His wide experience in the supply business and his proven ability as an organizer should be the means of greatly strengthening the jobbing interests on the Coast. Incidentally he is again a strong candidate for the old copper cup which has long been the supreme trophy contested for at the quarterly golf games played by the jobbers.

R. A. Lundquist, consulting engineer of Minneapolis, has been selected by the Bureau of Foreign and Domestic Commerce, Department of Commerce, to study the markets for electrical goods in China, India, Australia, South Africa and a number of other countries in the Far East. There was a time when American electrical goods met with considerable competition in the Far East, but the war has greatly handicapped the principal European competitors, and American manufacturers are making a serious effort to take advantage of the situation and get permanent possession of the markets. A great deal of preliminary study is still needed, and Special Agent Lundquist's part in the campaign will be to ascertain the types, qualities and costs, of electrical apparatus with which American goods come into competition, as well as to look into the general opportunities for the sale of such goods. Before leaving on the trip the special agent will spend some weeks in the principal business and manufacturing centers conferring with manufacturers, exporters, and business houses on the scope of the investigation. Mr. Lundquist was graduated from the University of Minnesota in 1905 with the degree of Electrical Engineer, following which he put in six years with prominent electrical houses. Since 1911 he has been in business for himself in Minneapolis, specializing in hydroelectric and transmission-line work. He is the author of "Transmission Line Construction—Methods and Costs," and has contributed numerous articles to the technical press.

NOTES OF CALIFORNIA WATER COMMISSION.

The Walker Mining Company of Salt Lake City, has applied to the commission for permission to appropriate 20 cubic feet per second of the waters of Ward and Nye Creeks in Plumas county for power purposes, used in mining and milling. The sources of diversion are tributaries of the Feather River. The total fall to be utilized is 514.4 ft. and the amount of power to be developed is 1165 theoretical horsepower by means of two Pelton wheels. The water is to be returned to Ward Creek after use.

The California Farm & Irrigation Company of San Francisco, has applied to the commission for permission to appropriate 375 cubic feet per second of the waters of the Colorado River in Riverside county. The application sets forth that by a pipe line and tunnel six miles long the water is to be conveyed to 60,000 acres, the works to be known as the Palo Verde Irrigation Canal. The water is to be diverted from the river by pumping plants and the estimated cost of the project is given as \$2,300,000. The details of the proposition are as yet incomplete.

SUSTAINING NIAGARA'S BEAUTIES THROUGH THE NIGHT—ELECTRICALLY.

To gaze upon the tumbling, seething waters of Niagara Falls is to gaze upon America's most beautiful work of Nature. A pity it has been that the coming of night shut out from the visitor's eyes the beauties and wonders of the falling waters that only the day disclose. Many the visitor who forebore a stop-over at the Falls because his train stopped at Niagara after the sun went down. Partly through altruistic motives and partly because of business and advertising the city of Niagara Falls, New York, appointed a committee to suggest a plan of flood lighting this city's prime attraction.

As a result of this demonstration and because of the extreme simplicity and low upkeep of the light, the contract for flood lighting the Falls was awarded to the Western Electric Company. The flood lighting unit that will be used is a standard light that the Western Electric Company has installed throughout the country to flood light bathing beaches, large industrial plants, railroad yards and for every use where light at night is essential.

NEW BULLETINS AND CATALOGUES

"Constants of Spectral Radiation of a Uniformly Heated Inclosure or So-called Black Body, II," is the subject of Scientific Paper No. 284 of the Bureau of Standards. The analysis of energy from a uniformly heated inclosure involves the determination of the amount of energy at various wave lengths in the spectrum. The present paper gives a precise re-computation of constants involved.

A new publication of the Bureau of Standards (Scientific Paper No. 283) entitled "Volume Effect in the Silver Voltameter," is ready for distribution. This paper is a continuation of the Bureau's researches on the Silver Voltameter which is the primary standard for the measurement of the International Ampere. It has been found that when the electrolyte for the voltameter is not sufficiently pure that the deposits in the large voltameters are in excess of those in the small voltameters in series with them.

The Bureau of Standards (Scientific Paper No. 281) entitled "A Study of the Inductance of Four-Terminal Resistance Standards," has made its appearance. This paper deals with the inductance of electrical resistance of less than one ohm. New methods of measuring alternate current require small resistances in the laboratory tests. Even very small errors in a standard would introduce serious errors in resulting measurements. This represents an important and practical contribution to precision measurements.

Bureau of Mines Technical Paper 145, just issued, is entitled Sensitiveness to Detonation of Trinitrotoluene and Tetranitromethy Canilin.

Technical Paper 161 of the Bureau of Mines, just issued, is entitled The Construction and Operation of a Single-tube Cracking Furnace for Making Gasoline, and deals with the general principles involved in the cracking of oils and distillate by the Rittman process.

"How to Build Up Furnace Efficiency" is the title of a booklet just issued by Jos. W. Hays, combustion engineer.

This little book treats in an interesting and efficient manner the subject matter suggested in the title under five headings: "Why your fuel is wasted," "How your fuel is wasted," "How to 'spot' your fuel wastes," "How to stop your fuel wastes" and "How to keep the wastes stopped." The book is written in a free, open, popular style void of high sounding technical terms and theory. Its purpose is to show "why," "how," and "where" fuel is wasted in the boiler room and to prescribe the remedy. While the major portion of the text deals largely with coal consuming plants, still an appendix has been added on fuel oil burning that will be of much practical assistance to Pacific Coast central stations using crude oil as fuel. The book should be in the hands of every up-to-date fireman and central station operator. The author is a combustion engineer and has written several other practical works on combustion.

TRADE NOTES.

The Electrical Contractors' and Dealers' Association of San Francisco have passed a resolution condemning the system of concentric wiring, as they believe it does not make for better and safer installations.

The Department of Electricity of San Francisco has recently made a ruling that all wires in conduits in a basement slab must be lead covered.

F. E. Newberry Company of San Francisco, have been awarded the contract for the electrical work in the new Chemistry Building at the University of California, and the McFell Electric Company have the contract for Hilgard Hall.

The Standard Electric Works of San Francisco have the electrical contract for the new Santa Fe Building, Second and Market streets San Francisco.



NEWS NOTES



INCORPORATIONS.

SALEM, ORE.—The Pringle Falls Electric Power Company of La Pine, Ore., has filed articles of incorporation with E. L. Clark, A. D. Lee and F. W. Thomas, incorporations and capital stock of \$500,000.

ILLUMINATION.

SANTA BARBARA, CAL.—The question of ornamental lamp posts is again under consideration.

TWIN FALLS, IDAHO.—The Idaho Power Company is to install a new street lighting system here.

FULLERTON, CAL.—The board of trade is considering the matter of installing a system of ornamental lights on Spadra avenue.

LOS ANGELES, CAL.—A request for furnishing lights for Homeward Avenue Lighting District through the county mechanical department, has been granted by the board of supervisors.

SACRAMENTO, CAL.—City Commissioner Thomas Coulter has gone on record in favor of establishing a municipal lighting plant. The city pays the Pacific Gas & Electric Company \$70,000 a year for street lighting.

ESCONDIDO, CAL.—At an auction conducted by the Los Angeles Trust & Savings Company, trustee, the plant of the Escondido Utilities Company, making gas and electric current, was sold for \$10,000 to Miss Mary K. Wohlford.

SAN LUIS OBISPO, CAL.—The board of supervisors of San Luis Obispo County have called a special election to be held August 29 to vote on the proposed formation of the Margarita Public Highway Lighting District.

BAKER, ORE.—To co-operate in the improvement of Main street when the new combination single standard and cluster lights are installed, the Eastern Oregon Light & Power Company has agreed to remove all its poles from the street.

GOLDFIELD, NEV.—The Globe Gas Company has applied for a franchise to operate a gas heating and lighting system in this city. It is stated that 130 miles of 4 in. and 6 in. pipe has been purchased and that the company plans to lay about nine miles of mains in Goldfield and altogether about 56 miles of pipe.

FRESNO, CAL.—Bids submitted by six electrical firms of the proposed electrolier lighting system in court house square were all rejected. When the county surveyor made his survey he estimated that the total cost would not be in excess of \$9500. The smallest bid received was \$13,987. Supervisor Johnson made a motion that the entire matter be referred to the county purchasing agent for investigation, his idea being that the county do the work.

LOS ANGELES, CAL.—In connection with the construction of the proposed municipal street lighting system in the East Los Angeles district, including Bairdstown, and the proposed construction of a system in the Hollywood district, the board of public works has asked that the public service commission fix rates for furnishing and maintaining the following classes of service: 1000 c.p. 20-ampere street service lamps, 400 c.p. 15-ampere lamps and 80 c.p. 6.6 ampere lamps, ornamental post lighting on basis of price per kilowatt hour, including current, renewal of lamps and maintenance.

BANNING, CAL.—The Riverside County Gas & Power Company has purchased the Banning and Beaumont Gas

plants and distributing systems and in thirty days will take possession of business in both cities. The plant at Beaumont will be rebuilt and a gas supply manufactured at that place, and a high pressure line will be laid to Banning to feed the distributing system. The old gas companies retain an interest in the new company, which has the following officers and directors: President, N. W. Farr; secretary, Farr McComb; vice-president, D. H. Gates; secretary and manager, F. N. Hawes, K. R. Smoot; treasurer, E. D. Reynolds; comptroller, First National Bank of Banning. H. W. Burkhardt, is engineer.

TRANSMISSION.

YREKA, CAL.—H. O'Connor and crew are running a survey from Mott to McCloud preparatory to the construction of a power line into the McCloud district.

BAKERSFIELD, CAL.—The Southern Sierra Power Company has applied for a franchise for a transmission line for which the supervisors will receive bids up to September 7th.

GREAT FALLS, MONT.—The Montana Power Company will expend \$500,000 on improvements to the plant, adding 13,000 h.p. at Rainbow Falls.

SOUTH BEND, WASH.—The Northwest Electric & Waterworks has ordered clearing of a site for the proposed new 300,000 gallon reservoir near here.

BUTTE, MONT.—An official count of the vote cast by property owners upon the question of granting lighting and heating franchise to the Montana Power Company shows that both franchises carried.

RIVERSIDE, CAL.—The Southern California Edison Company has notified the board of public utilities of its intention to construct a new transmission line to provide the city with an additional circuit.

REDLANDS, CAL.—The sum of \$15,000 will be expended by the Pacific Light & Power Company in rebuilding and enlarging the company's power line crossing streams in San Bernardino and Riverside counties, it is stated.

ENTERPRISE, ORE.—Preparations for the construction of the new high voltage transmission line to connect the Joseph plant with the other parts of the system of the Enterprise Electric Company are under way. L. M. Simpson is general manager.

LOS ANGELES, CAL.—The Pacific Power Corporation, subsidiary of the Nevada-California Power Company, is building a large plant on Silver Lake, just north of Owens Valley. The plant, costing approximately \$100,000 will generate 16,000 h.p. when completed and will consist of two units. Fred L. Polson, C. B. Poole and E. J. Waugh are in charge of the work.

EUGENE, ORE.—The city of Eugene has a project on foot for the removal of all poles from Willamette street, the principal business thoroughfare of the city. The municipal water board announced today that the poles of the old Oregon Power Company's distributing system, recently purchased by the city, will be removed at once. All poles in connection with the city's electrical plant are in the alleys.

SAN FRANCISCO, CAL.—Contracts have been awarded by the Board of Public Works for the necessary machinery for the Cherry Creek power station that will be part of the Hetch-Hetchy water supply project. The power generated at this station will be utilized in the construction work of

the Hetch-Hetchy dam and in the boring of the water tunnels along the line of the water conduits. The Pelton Water Wheel Company will supply the hydraulic machinery and the generators will be furnished by the General Electric Company.

STOCKTON, CAL.—A new electric furnace installed by the Monarch foundry is now operating at full capacity. This is the first electric furnace installed in Stockton, and has proven very satisfactory. Energy is supplied for operation by the Western States Gas & Electric Company. It is estimated that the company's annual revenue from this installation will be upwards of \$5000. The Samson Iron Works is now considering the installation of a $\frac{3}{4}$ -ton electric furnace for similar purposes.

SALEM, ORE.—Application to appropriate water from Multnomah and Peterson creeks for power development purposes was filed with State Engineer Lewis by Charles Coopey of Portland. Whether the application can be allowed under the act of the 1915 legislature, which withdrew from appropriation the waters of Multnomah Creek, has been referred to Attorney-General Brown for decision. If the application is granted it is the intention to divert the water from above Multnomah Falls and return it to the creek above the falls. The cost of developing the power project is estimated at \$20,000.

WILLIAMS, ARIZ.—It is understood that E. P. Ripley, president of the Santa Fe, and his associates have taken over the Grand Canyon reservoir and hydroelectric project. Plans for this enterprise involve the building of a dam across one of the laterals of the Grand Canyon and the storage of water for operating one of the largest hydroelectric plants in this country, including the irrigation of more than 200,000 acres of land. Electric power transmission lines are expected to be constructed to mining districts, towns and industrial centers within a radius of 200 miles of the generating plant. The dam will be the highest in the world. Some of the engineers are already on the ground. It is understood that permanent surveys will be finished and construction work started before the middle of November.

TRANSPORTATION.

WHITTIER, CAL.—The Pacific Electric Railway Company, has been granted a 50 year franchise on certain portions of Philadelphia street.

SACRAMENTO, CAL.—The Northern Electric Company has been granted permission by the State Reclamation Board to construct a steel bridge across the American River.

GLENDALE, CAL.—Plans are under way to secure a right of way for an extension of the Pacific Electric Railway to a junction with the main Los Angeles line in Tropic.

MISSOULA, MONT.—The Missoula Street Railway Company will extend its line to the site of the proposed factory of the Great Western Sugar Company, same to cost about \$25,000.

BREA, CAL.—At a meeting of the chamber of commerce at Brea a committee was appointed to confer with the Pacific Electric Railway asking that company, when it extends its line to Fullerton, to make the extension to Brea.

HELENA, MONT.—Jesse R. Roote, who has been in charge as resident director of the Keating gold property, makes the statement that the proposed electric railway from Toston into the Radersburg district is being surveyed. The proposed road will be 12 miles long.

PORTLAND, ORE.—According to the quarterly statement just issued by the Portland Railway, Light & Power Company the number of cars used by the company was 591. The operating expenses for traffic and lighting was \$1,303,853, and operating revenue, \$1,356,451, the valuation of its plant is given as \$59,387,628.

PORTERVILLE, CAL.—High officials of electric lines, with several prominent business men, have been touring this part of the county, with the admitted object of considering possible routes for new electric lines that may be built here in the future. In the party, besides the Porterville men, were Paul Shoup, president of the Pacific Electric; F. W. Webster, superintendent of the valley electric lines of the Southern Pacific, and W. P. Ballard, superintendent of the Visalia Electric Railway.

TELEPHONE AND TELEGRAPH.

DAYTON, WASH.—The city council has granted the Pacific Telephone & Telegraph Company the right to operate here.

OLYMPIA, WASH.—The Elma Matlock Telephone Company, capitalized at \$5000, will provide a farmers' telephone system about Elma.

YUBA CITY, CAL.—According to the city assessment roll this year, the Pacific States Telephone & Telegraph Company has 6.2 miles of poles and 320 miles of wire here.

WILCOX, ARIZ.—The superintendent of the Tri-State Telephone Company of El Paso has been in Wilcox to confer with officials of the local telephone company regarding arrangements for the Tri-State company to run a copper wire into the local office and thus afford Wilcox long distance service to El Paso and Los Angeles.

NOGALES, ARIZ.—W. A. Getline and Pat Patterson, residents of Patagonia, have made application to the supervisors of Santa Cruz County for a franchise to operate telephone lines along the public highways from Patagonia to Nogales, from Patagonia to Sonoita and Elgin, from Patagonia toward Fairbank, from Patagonia to Harshaw, up Harshaw Canyon and to San Rafael postoffice and vicinity. A public hearing of the application will be held on September 5th.

IRRIGATION.

SALEM, ORE.—State Engineer Lewis and J. T. Whistler of the U. S. Reclamation Service have prepared plans for reclaiming about 6000 acres of land along the White River in Wasco county. This will cost about \$1,726,000.

PROSSER, WASH.—O. Laurgaard, who was employed by the Horse Heaven Irrigation District to make investigations concerning the feasibility and cost of the project, has brought in a favorable report, which places the cost at \$50 an acre and up.

MADERA, CAL.—Water users of this district have organized and will oppose the attempt of the Madera Canal and Irrigation Company to increase the rates. J. L. Davis has been named president of the Water Users' Association, and Walter Schmitz is secretary-treasurer.

TERRA BELLA, CAL.—At an election held here the electors voted the issuance of \$1,000,000 in 20-year 6 per cent bonds for the construction of the Terra Bella Irrigation District. About one-sixth of the area which will be reached by the pumping system is now planted with citrus and olive trees.

REDDING, CAL.—The main canal of the Anderson-Cottonwood Irrigation District, according to James Willison, the contractor, is one-half completed. It is finished from Redding to China Gulch and from Anderson to Cottonwood, with the exception that here and there are places that need a little touching up.

VALE, ORE.—An election was held here recently for the purpose of voting on a proposed issue of \$750,000 bonds to construct the Warm Springs irrigation project. It was anticipated that the election would be carried, in which event it is not unlikely that bids for both the bonds and work will be invited soon.

ST. MARIES, IDAHO.—Bids will be received by Court M. Sargent, secretary here, up to noon August 31 for construction work and material for Drainage District No. 2, Benewah county, Idaho. Engineer's estimate of yardage, 120 000 cu. yds.; embankment, 23,000 cu. yds.; ditches. Certified check for 5 per cent of bid required. M. S. Parker, engineer.

ISSAQUAH, WASH.—The commissioners of Drainage District No. 4, Issaquah, Wash., have awarded the contract to the Chamberlain Construction Company, Globe Block, Seattle, for draining about 1000 acres of land in the Issaquah valley for about \$11,000. The work involves removal of 50,000 cu. yds. of material.

OAKDALE, CAL.—Litigation is likely to follow the filing of the newly built Strawberry reservoir by the Sierra and San Francisco Power Company. The Oakdale Irrigation District has requested the power company to desist from taking water from the Stanislaus River to fill the reservoir, as the district has title to the flow of the stream, with the exception of 55 second feet.

LINDSAY, CAL.—At the opening of bids for the construction of the Lindsay-Strathmore Irrigation system three bidders were present, and submitted the required certified checks to cover the aggregate amount of figures on their work. Shattuck & Eddinger of Los Angeles presented a check of \$140,000; Frank Kennedy of Los Angeles, one for \$125,000; the McClellanham-Craner-Carter Company, also of Los Angeles offered \$120,000. The bids were taken under advisement.

MADERA, CAL.—The Chowchilla Reclamation District has been formally organized at the meeting of the supervisors. The district will include 79,033.41 acres, this acreage excluding the Bliss ranch of 9600 acres. Of this acreage, 67,593.41 acres are in Madera County and the balance in

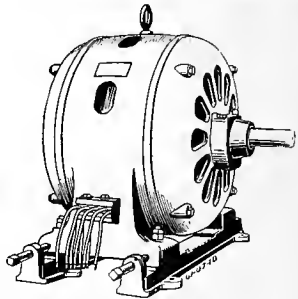
Merced County. The plan is to confine the waters of the Fresno, Chowchilla rivers and the several sloughs tributary to these rivers and the San Joaquin River, inside their banks, so that they will not overflow as they do now.

SACRAMENTO, CAL.—The reorganization and ultimate completion of an irrigation project, formerly known as the central irrigation canal and more recently known as the Kuhn project, for irrigating 200,000 acres in the counties of Colusa and Glenn, seems now an assured fact. The interests of the Kuhns have been eliminated through foreclosures and a system is now developing, under direction of D. W. Ross, that will eventually comprise an area of 215,000 acres, bounded on the east by the Sacramento River and on the west by the central canal of the district. Mr. Ross states that there are 25,000 acres under irrigation this year in the district.

B P

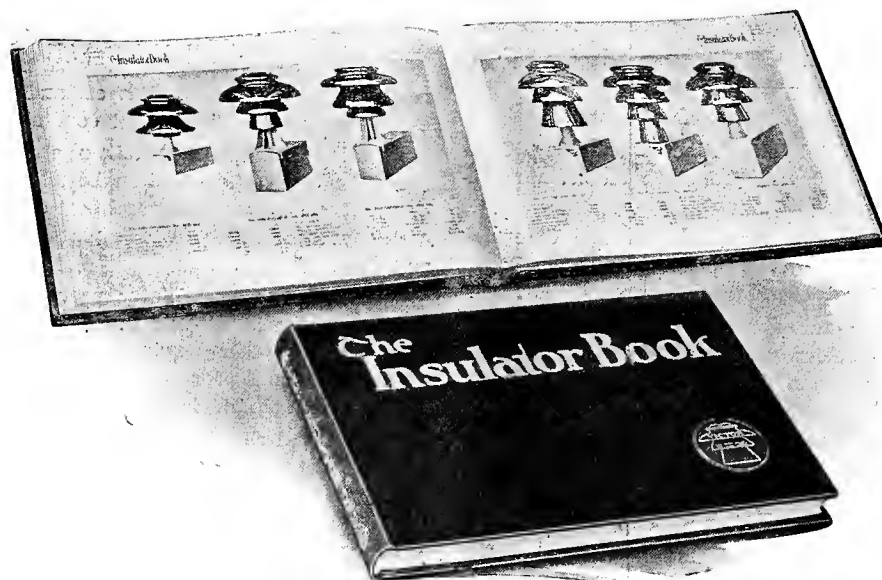
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Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
12

	3/4-Inch.	List.	Sell.
21, 1 Wire15	.15
22, 2 Wire15	.15
23, 3 Wire15	.15
2400, 4 Wire15	.15
24, For W. P. Socket25	.25
25, 1/2 Metal Male Nipple25	.25
26, 1/2 Metal Female Nipple25	.25
27, 3/8 Metal Male Nipple30	.30
28, 3/8 Metal Female Nipple30	.30
29, 1/2 Porc. Male Nipple30	.30
210, 1/2 Porc. Female Nipple30	.30
211, 3/4 Porc. Male Nipple41	.45
212, 3/4 Porc. Female Nipple41	.45
200, Blank Metal Cover11	.15
1-Inch.			
31, 1 Wire25	.25
32, 2 Wire25	.25
33, 3 Wire25	.25
3400, 4 Wire25	.25
34, For W. P. Socket40	.40
35, 1/2 Metal Male Nipple35	.35
36, 1/2 Metal Female Nipple35	.35
37, 3/8 Metal Male Nipple40	.40
38, 3/8 Metal Female Nipple40	.40
39, 1/2 Porc. Male Nipple43	.45
310, 1/2 Porc. Female Nipple43	.45
311, 3/4 Porc. Male Nipple53	.55
312, 3/4 Porc. Female Nipple53	.55
300, Blank Metal Cover23	.25
1 1/4-Inch.			
42, 2 Wire36	.40
43, 3 Wire36	.40
4400, 4 Wire36	.40
4500, 5 Wire36	.40
4600, 6 Wire36	.40
400, Blank Metal32	.35
1 1/2-Inch.			
52, 2 Wire48	.50
53, 3 Wire48	.50
5400, 4 Wire48	.50
5500, 5 Wire48	.50
5600, 6 Wire48	.50
5700, 7 Wire48	.50
500, Blank Metal45	.45
2-Inch.			
63, 3 Wire60	.60
600, Blank Metal50	.60
2 1/2-Inch.			
73, 3 Wire80	.80
700, Blank Metal75	.75
3-Inch.			
83, 3 Wire80	.80

The correctness of these suggested selling prices is not guaranteed by the publisher. Suggestions for corrections are invited.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
11

Type "LF", "LB", "LR", "LL"—
Without Covers, but With
Cover Screws.

Cat. No.	1/2 in.	3/4 in.	1 in.	List.	Sell.
L-11-F,	1/2 in.	.....	.....	.40	.40
L-22-F,	3/4 in.	.....	.....	.45	.45
L-33-F,	1 in.	.....	.....	.65	.65
Type "T."					
T-111,	1/2 x 1/2 x 1/2	.....	.....	.48	.50
T-121,	1/2 x 3/4 x 1/2	.....	.....	.56	.60
T-131,	1/2 x 1 x 1/2	.....	.....	.63	.65
T-212,	3/4 x 1/2 x 3/4	.....	.....	.57	.60
T-222,	3/4 x 3/4 x 3/4	.....	.....	.57	.60
T-232,	3/4 x 1 x 3/4	.....	.....	.65	.65
T-242,	3/4 x 1 1/4 x 3/4	.....	.....	.77	.80
T-312,	1 x 1/2 x 1	.....	.....	.80	.80
T-322,	1 x 3/4 x 1	.....	.....	.80	.80
T-332,	1 x 1 x 1	.....	.....	.80	.80

Types "TR", "TL"

T-111-R,	1/2 x 1/2 x 1/2	.....	.48	.50
T-121-R,	1/2 x 3/4 x 1/2	.....	.56	.60
T-232-R,	3/4 x 3/4 x 3/4	.....	.57	.60
T-332-R,	1 x 1 x 1	.....	.80	.80

Type "V"—Complete.

1089, 1/2 x 2 3/4 x 5 1/4	.....	4.50	4.50
2089, 3/4 x 2 3/4 x 5 1/4	.....	4.55	4.70
H-1089, 1/2 x 3 3/4 x 7 3/4	.....	5.40	.....
H-2089, 3/4 x 3 3/4 x 7 3/4	.....	5.45	.....

Type "X."

X-1111,	1/2 x 1/2 x 1/2	.....	.60	.60
X-2222,	3/4 x 3/4 x 3/4	.....	.77	.80
X-3333,	1 x 1 x 1	.....	1.05	1.05

COVERS.

1/2-Inch.

11, 1 Wire	.....	.10	.10
12, 2 Wire	.....	.10	.10
13, 3 Wire	.....	.10	.10
1400, 4 Wire	.....	.10	.10
14, For W. P. Socket	.....	.16	.20
15, 1/2 Metal Male Nipple	.....	.20	.20
16, 1/2 Metal Female Nipple	.....	.25	.25
17, 3/8 Metal Male Nipple	.....	.25	.25
18, 3/8 Metal Female Nipple	.....	.25	.25
19, 1/2 Porc. Male Nipple	.....	.35	.35
112, 1/2 Porc. Female Nipple	.....	.25	.25
110, 1/2 Porc. Female Nipple	.....	.25	.25
111, 3/4 Porc. Male Nipple	.....	.35	.35
100, Blank Metal Cover	.....	.10	.10
100, Blank Metal Cover	.....	.08	.10

The correctness of these suggested selling prices is not guaranteed by the publisher. Suggestions for corrections are invited.

ALPHABETICAL INDEX TO ADVERTISERS

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Kearns Bldg., Salt Lake City; Sheldon Bldg., San Fran-
cisco; Mutual Life Bldg., Seattle; Santa Rita Hotel
Bldg., Tucson. |
| A-2 Atchison, Topeka & Santa Fe Railway Co.....
673 Market St., San Francisco; 1218 Broadway, Oakland. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| B-1 Baker-Joslyn Company..... 4
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| C-3 Crocker-Wheeler Co.....
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St. No., Portland; 200-210 Twelfth St., Oakland; 575
Mission St., San Francisco; 307 First Ave. So., Seattle. |
| E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los
Angeles. | P-4 Pelton Water Wheel Co..... 13
2219 Harrison St., San Francisco. |
| E-2 Edison Storage Battery Supply Co..... 13
441 Golden Gate Ave., San Francisco. | P-5 Plerson, Roeding & Co.....
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San
Francisco; Colman Bldg., Seattle. |
| E-3 Electric Agencies Co.....
247 Minna Street, San Francisco; Central Building,
Los Angeles. | P-6 Pittsburgh Electric Specialties Company.....
202 Aronson Bldg., San Francisco. |
| E-6 Electric Novelty Works.....
533 Mission St., San Francisco. | P-7 Pittsburgh Piping & Equipment Co..... 14
Monadnock Bldg., San Francisco. |
| E-4 Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco. | S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco. |
| E-5 Electric, Railway & Manufacturing Supply Co..... 13
34 Second St., San Francisco. | S-4 Southern Pacific Co..... 3
Flood Bldg., San Francisco |
| F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission St., San Francisco;
Seattle; Spokane. | S-5 Sprague Electric Works..... 14
Rialto Bldg., San Francisco; Colman Bldg., Seattle;
Corporation Bldg., Los Angeles; Electric Bldg., Port-
land; Paulsen Bldg., Spokane. |
| F-3 Federal Sign System (Electric)..... 11
618 Mission St., San Francisco. | S-6 Standard Underground Cable Co..... 14
First National Bank Bldg., San Francisco; Hibernian
Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815
Newhouse Bldg., Salt Lake City, Utah. |
| G-1 General Electric Co..... 12
724 So. Spring St., Los Angeles; Worcester Bldg., Port-
land; Rialto Bldg., San Francisco; Colman Bldg.,
Seattle; Paulsen Bldg., Spokane. | T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co.,
Pacific Coast Representatives. |
| G-1 General Vehicle Co.....
1117 Van Ness Ave., San Francisco; 331 Wall St., Los
Angeles; British Columbia Electric Ry., Ltd., Van-
couver, B. C. | T-2 Tubular Woven Fabric Company..... 4
Pawtucket, R. I. |
| H-1 Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.) | U-1 United Sheet Metal Works.....
575 Howard St., San Francisco. |
| H-2 Hemingray Glass Co..... 13
236-240 So. Los Angeles St., Los Angeles; 345 Oak St.,
Portland; 807 Mission St., San Francisco. | W-1 Wagner Electric Manufacturing Company..... 7
St. Louis, Mo. |
| H-3 Haller-Cunningham Electric Co.....
428 Market St., San Francisco. | W-2 Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph
Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907
First Ave., Seattle; 45 North Fifth St., Portland, Ore. |
| H-5 Hunt, Mirk & Co.....
141 Second St., San Francisco. | W-3 Ward-Leonard Electric Co..... 14
Mt. Vernon, New York. |
| H-7 Hurley Machine Co..... 2
New York and Chicago. (See Pacific States Electric Co.) | W-4 Westinghouse Electric and Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los
Angeles; Couch Bldg., Portland; 212 So. W. Temple,
Salt Lake City; 165 Second St., San Francisco; Second
and Cherry Sts., Seattle; Paulsen Bldg., Spokane. |
| I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles. | W-5 Westinghouse Machine Co.....
141 Second St., San Francisco. |
| I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco. | W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.) |
| L-1 Leahy Manufacturing Co..... 13
Eighth and Alameda St., Los Angeles. | W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway,
Los Angeles |
| L-2 Locke Insulator Manufacturing Co..... 7
(See Pierson, Roeding & Co.) | |
| M-2 McGlauflin Manufacturing Co..... 13
San Rafael, Cal. | |
| M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco. | |

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SAN FRANCISCO, SEPTEMBER 2, 1916

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BY H. F. BOYNTON.

IMPEDANCES OF IRON AND STEEL WIRE.
BY CLEM A. COPELAND.

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OF IRRIGATION CANALS.
BY S. T. HARDING.

COINCIDENCES AND ANTICIPATIONS OF
DISCOVERY.
BY A. L. JORDAN.

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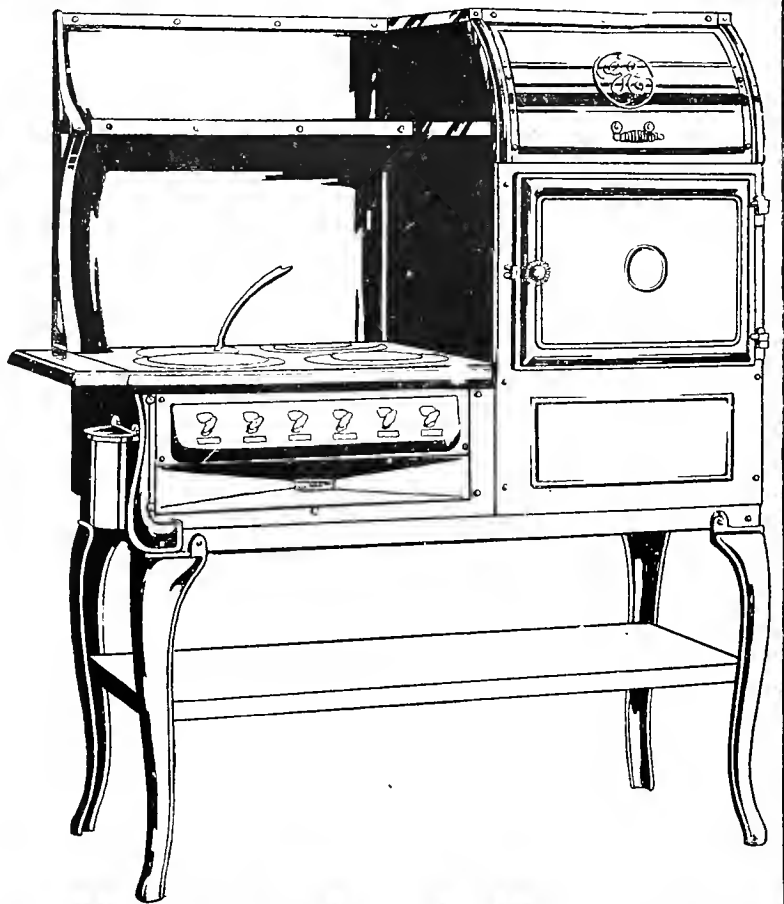
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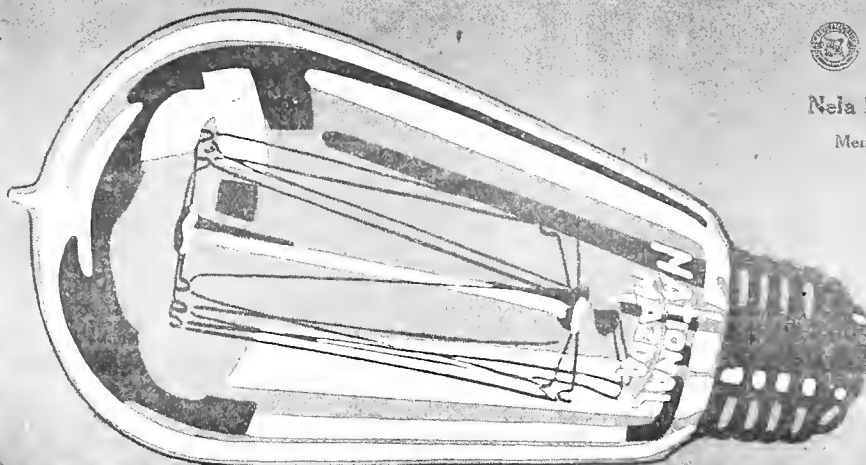
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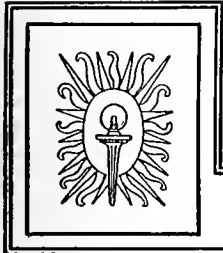
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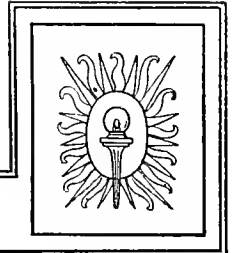




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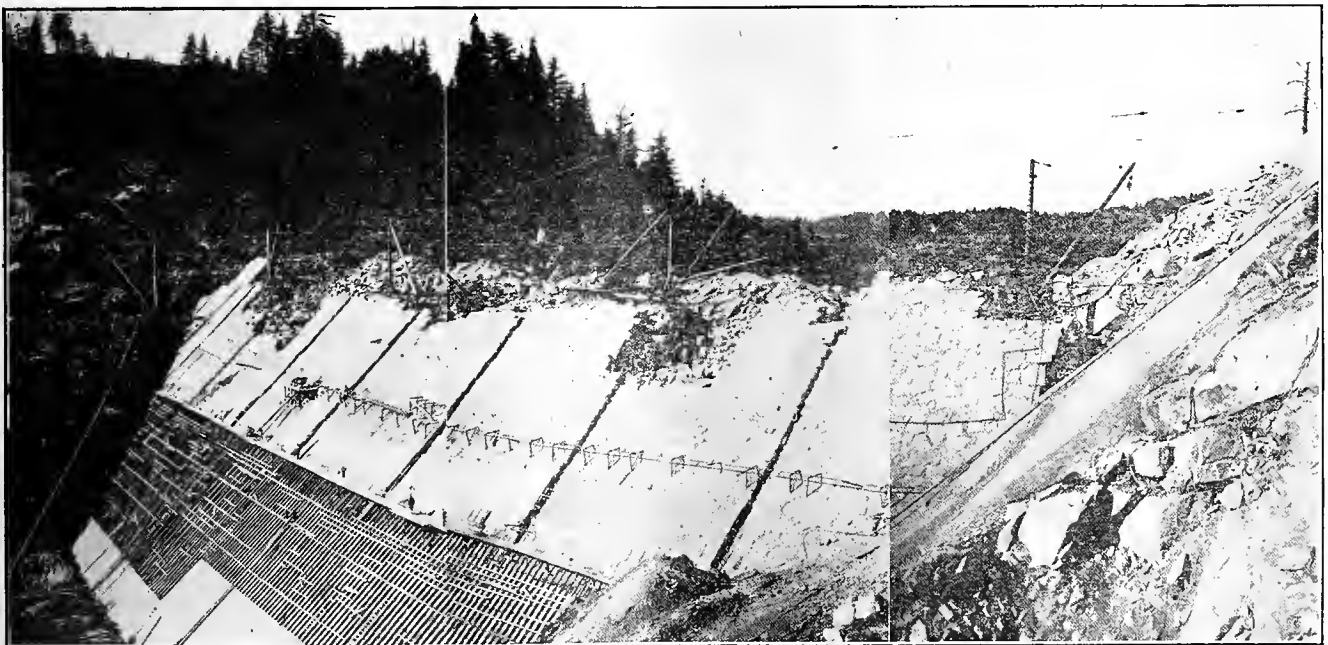
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THE STRAWBERRY DROP-FILLED DAM

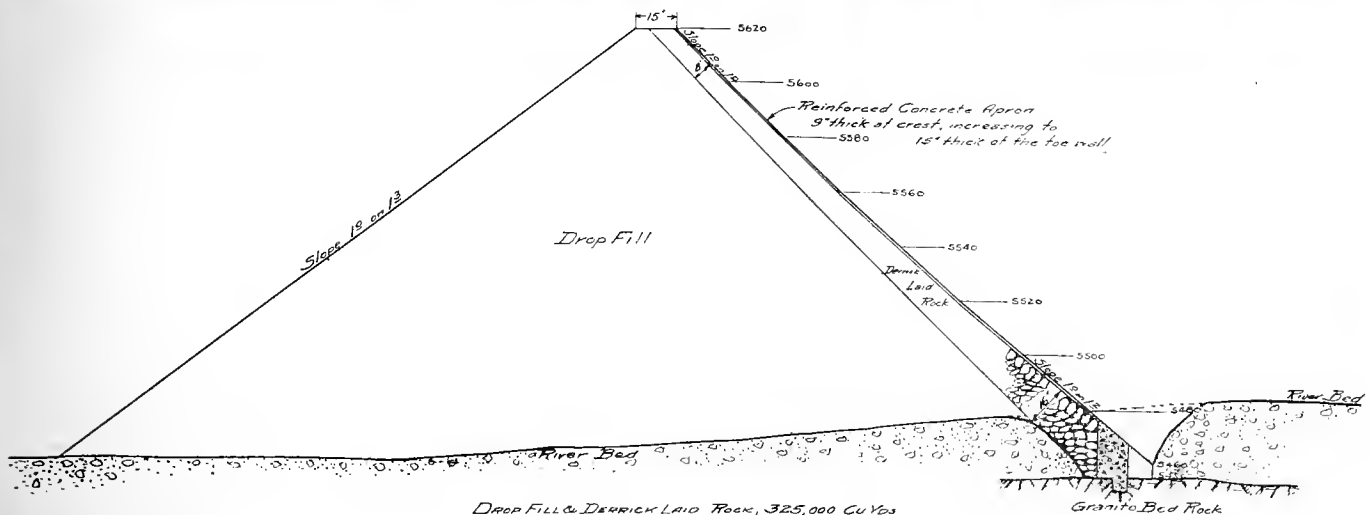
The second of a series of five great impounding reservoirs constituting the Stanislaus storage system of the Sierra & San Francisco Power Company is a drop-filled granite dam, which has just been completed at Strawberry, 32 miles northeast of Sonora, California, and the same distance from the Hetch Hetchy development, where a similar dam is to be built by

the City of San Francisco. The structure is not only noteworthy as the largest of its type in the West, but is also interesting because of the novel construction methods used.

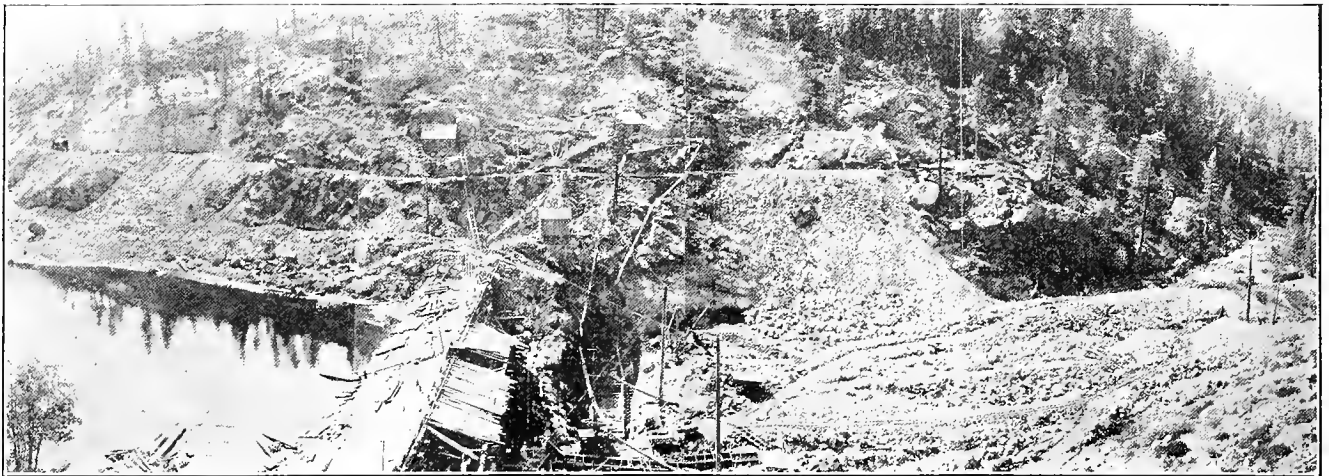
The rock-fill type was selected because of the excellent bed-rock, the fine granite available and the 19-mile haul from the nearest railroad should concrete



Strawberry Dam, Nov. 29, 1915, showing Lower Portion of Concrete Apron and Upper Section of Derrick Laid Section.



Cross Section of Strawberry Dam.



Strawberry Dam, Oct. 1913, showing Old Timber Crib Dam, Excavation for Concrete Toe-wall and Cleared Fill Site.

be used. It takes the place of a log-cut dam built in 1861, whose timbers, by the way, were found to be sound after one-half a century's service.

The dam crest is 620 ft. long, arched upstream with 20 ft. ordinate, and 170 ft. above bed-rock. The dam is 380 ft. wide at the base, and 15 ft. wide at the top, and has an upstream step varying from 1 on 1.2 at the bottom, or 1 on 1 at the crest. The major portion is a drop-fill section supporting a laid wall and concrete apron on the upstream side. Any settling movement will tend to shorten the length of the arch and to close possible cracks in the apron, especially as the upper two-thirds of the apron is built in 60 ft. sections, free to slide on a smooth 3 in. layer of cement mortar. This is made possible by vertical expansion joints, supported by concrete ribs built into the laid section.

After clearing the dams site down to the cemented gravels of the river bed with steam shovel and hydraulic giant, a trench was excavated across the bottom of the canyon to a depth of 33 ft. to bedrock,

being filled with concrete to form a toe-wall. Concrete was supplied through wooden flumes leading from mixers on the side hill.

The fill was made in two ways. A trestle was first built across the canyon at about the center of the fill section and gradually buried in quarried granite dropped into place from dump cars. This central row was then covered with rock transported by a system of cable-ways from seven surrounding quarries.

This cable system supported and radiated from a central "spider," each cable acting in the dual capacity of guy line and carrier. A single-line hoist at each quarry raised the loaded bucket from the pit to the cable, and by means of an automatic tripping device then lowered it to the desired place of dumping, this being accomplished by an automatic tripper actuated by a removable bumper on the carrier cable. The empty bucket was then drawn back, lowered to the pit and the cycle repeated—all by means of a single line. The central spider could be moved to any desired position by merely paying out or drawing in on



Strawberry Dam, June 2, 1915, showing Fill-trestle Almost Buried, Cable System in Operation and Derricks laying Rock Face.

any or all of the seven cables. This unique method easily and quickly handled 15 ton loads on $1\frac{1}{4}$ in. cable, or 800 ft. round trip requiring but two minutes.

Overlaying the fill is a derrick-laid wall of selected stones, weighing from 2 to 5 tons. These stones were carefully set to line by hand and wedged tightly into place. Space was left at 60 ft. parallel intervals for concrete ribs to support the apron. The laid-rock section is 16 ft. at the base and 8 ft. thick at the top.

The reinforced concrete apron is a continuation of the concrete toe wall, forming an impervious layer on the upstream face of the dam. It varies in thickness from 9 in. at the crest to 18 in. at the toe wall. For the lower one-third of the height it is monolithic the upper two-thirds, as already explained, being laid in sections to prevent cracks due to settlement or temperature changes.

This dam provides storage for nearly 18,000 acre feet through a 120 ft. outlet tower discharging into an outlet tunnel excavated through 600 ft. of rock. The outlet tower is of reinforced concrete, 10 ft. outside diameter and 5 ft. inside diameter. It is equipped with six 30 in. gate valves helically spaced at various elevations, these being operated by gate stems on top of the tower. The discharge end of the 5 ft. by 7 ft. tunnel is also equipped with needle valves.

A spillway 100 ft. in length and with lip 8 ft. below the dam crest is provided through solid rock at one side of the dam.

The water is used for both power generation and irrigation. It, together with other developed storage, assures an ample water supply for the 40,000 h. p. plant on the Stanislaus River with its 135 miles of double circuit 104,000 volt lines to San Francisco, as well as for future contemplated developments.

Construction has been carried on under the direct supervision of H. F. Jackson, vice-president and general manager of the Sierra & San Francisco Power Company, he being represented on the job by the engineering firm of Maloney, Howson & Doane. The contractors were Chadwick & Sykes of San Francisco. M. M. O'Shaughnessy acted as consulting engineer.

STUDY OF HYDROELECTRIC SITES IN CHILE.

By decree of July 1, 1916 (Ministry of Industry and Public Works), an honorary commission was appointed to make a study of the water power available in Chile for the purpose of hydroelectric development. The committee named is as follows: Senor Arturo E. Salazar, Senor Rafael Edwards S., Senor Horacio Valdes C., and Senor Abraham Guzman B. The addresses of the above-named gentlemen are: Escuela de Ingenieria de la Universidad de Chile, Santiago; Calle Agustinas, 1170, Santiago; Chacra Subercaseaux, Santiago; and Calle Bandera, 198, Santiago, respectively. The local press, in commenting approvingly on the appointment of a committee for the above purpose, quote the estimate of Prof. Don Arturo E. Salazar, of the University of Chile, that proper hydroelectric development in Chile would reduce the cost of electricity for the small consumer for commercial purposes from the present price of 70 centavos gold (\$0.255 United States currency) to 3 centavos gold (\$0.01095).

FUNDAMENTALS OF CLAIM DEPARTMENT WORK.

BY B. F. BOYNTON.

(This interesting discussion of departmental work in a claim office of a public utility company was delivered before the Pacific Claim Agents' Association Convention which met in Tacoma August 9 and 10. The author is in charge of the claim department for the Portland Railway, Light & Power Company.—The Editor.)

The fundamentals of Claim Department work, summed up, are efficiency, co-operation, courtesy, prevention of accidents, and fair, square dealings, both with the public and the company you represent.

To accomplish this, you must have competent, trustworthy investigators who will at all times when taking statements from witnesses or claimants, bring out the points, without bias, that are so necessary to the man in charge in determining the liability.

The office force that handles your records and do your filing should be selected as to their especial adaptation for correct filing and keen discernment, for with a corps of wide-awake office help a repeater or fraudulent claimant will very seldom pass through the hands of all without recognition.

The physicians and surgeons who represent a claim department should be big, broad, intelligent men—men who are judges of human nature—for the kind, courteous, considerate attention given a patient by the physician many, many times minimizes what might have been a bad claim to adjust. One of the most potent factors relative to the connection of the physicians with the claim department, should be a thorough understanding between the two, that the physicians should at all times in their reports to the claim department show the injuries up in said reports in such a way that the claim agent will know the exact extent of same.

The attorneys that try the cases for the claim department, should at all times, when dealing with the juries and witnesses, show a disposition to be absolutely fair and impartial; in other words, they should, in their connection with the work in trying cases show to the community at large that all the company which they represent seeks is absolute justice, let it hit where it may.

The prevention of accidents in connection with an electric railway is a very essential fundamental, and I think should be under the claim agent's supervision, as he is in a better position than anyone else to see what is causing different types of accidents, and if he is a man who has had any practical railroad experience, will have a good idea of what would be the best preventive.

Another important fundamental is co-operation between the claim department and the operating department; in fact, to obtain the best results, a claim department must have the hearty co-operation of each and every department connected with the utility company.

Again, I think a claim agent, himself, should not crawl into his "shell and hibernate" but that he should meet with the business men and people at large at their different gatherings and functions and show to the people that he takes an interest in the welfare of the community in which he lives in all its different phases.

willing at all times, if necessary, to give his time toward different public enterprises.

Lastly, I think that the different members of a claim department should be thoroughly schooled in treating the public in a kind, courteous manner, as a "kind word often turneth away wrath." There is nothing that any department in any large or small institution can do that brings about as good results as the practice of being polite and obliging. Members of a claim department should frequently hold meetings and exchange ideas on the best means of obtaining a higher standard of efficiency.

This is a subject that a man could go into and write on at great length, but I feel in the above that the principal fundamentals are covered.

CONCESSION FOR WATER POWER IN PERU.

The government of Peru has granted to the Hydroelectric Company, of the Canon del Pato, a concession for water power in the River Santa to be used for industrial purposes. The concession as published in El Peruano of July 12 grants water rights of 45,000 liters per second in a section of the river 500 meters above the confluence of the Santa with the Colcas for a distance of 25 kilometers, following the course of the River Santa. This water is conceded for manufacturing, and may not be used for any other purpose. Definite plans covering the utilization of the water must be presented before December 1 of next year, and the work must be completed within three years from that date.

IMPEDANCES OF IRON AND STEEL WIRE.

BY CLEM A. COPELAND.

(Herein are given a complete set of curves showing ratios of a.c. and d.c. resistances and inductances for iron and steel telephone wire, of Nos. 4-14, at various current densities. The values found from the curves can then be substituted in the simple formula already developed and from this the impedance in ohms due to skin effect can be readily calculated.—The Editor.)

Finally from all available sources the 12 curves of Figs. 13 to 26 have been prepared for 50 and 60 cycles, giving values of K_R and K_L , based on a straight line relation between the maximum value of K_R and K_L and the area of the wire. Here again theoretical considerations fail as from the argument in formula (3),

$$\kappa = \frac{2\pi r_1}{.3937} \sqrt{\frac{2\mu f}{10^9 \rho}}$$

(which is proportional to the superficial area) one would expect K_R maximum, to be a function of the diameter of the wire. For very large single wires, say No. 3 B. W. G. and larger, this latter relation may hold.

Some interesting practical considerations are derived from these curves.

	E. B. B.		Steel		E. H. S. Steel	
	$R_{dc} = 1.099$ (1000')	R_{ac}	$R_{dc} = 1.519$ (1000')	R_{ac}	$R_{dc} = 2.339$ (1000')	R_{ac}
Amp.	K_R	K_L	K_R	K_L	K_R	K_L
2	1.41	1.55	1.132	1.57	1.005	2.35
4	1.96	2.16	1.247	1.89	1.05	2.46
6	2.488	2.74	1.400	2.12	1.12	2.62
8	2.88	3.17	1.573	2.39	1.195	2.79
10	3.11	3.42	1.785	2.71	1.255	2.94
12	3.20	3.52	2.015	3.06	1.30	3.04
16	3.108	3.42	2.32	3.52	1.335	3.12
22	2.84	3.12	2.275	3.46	1.345	3.15
28	2.64	2.90	2.195	3.33	1.32	3.09
36	2.44	2.68	2.127	3.24	1.29	3.03

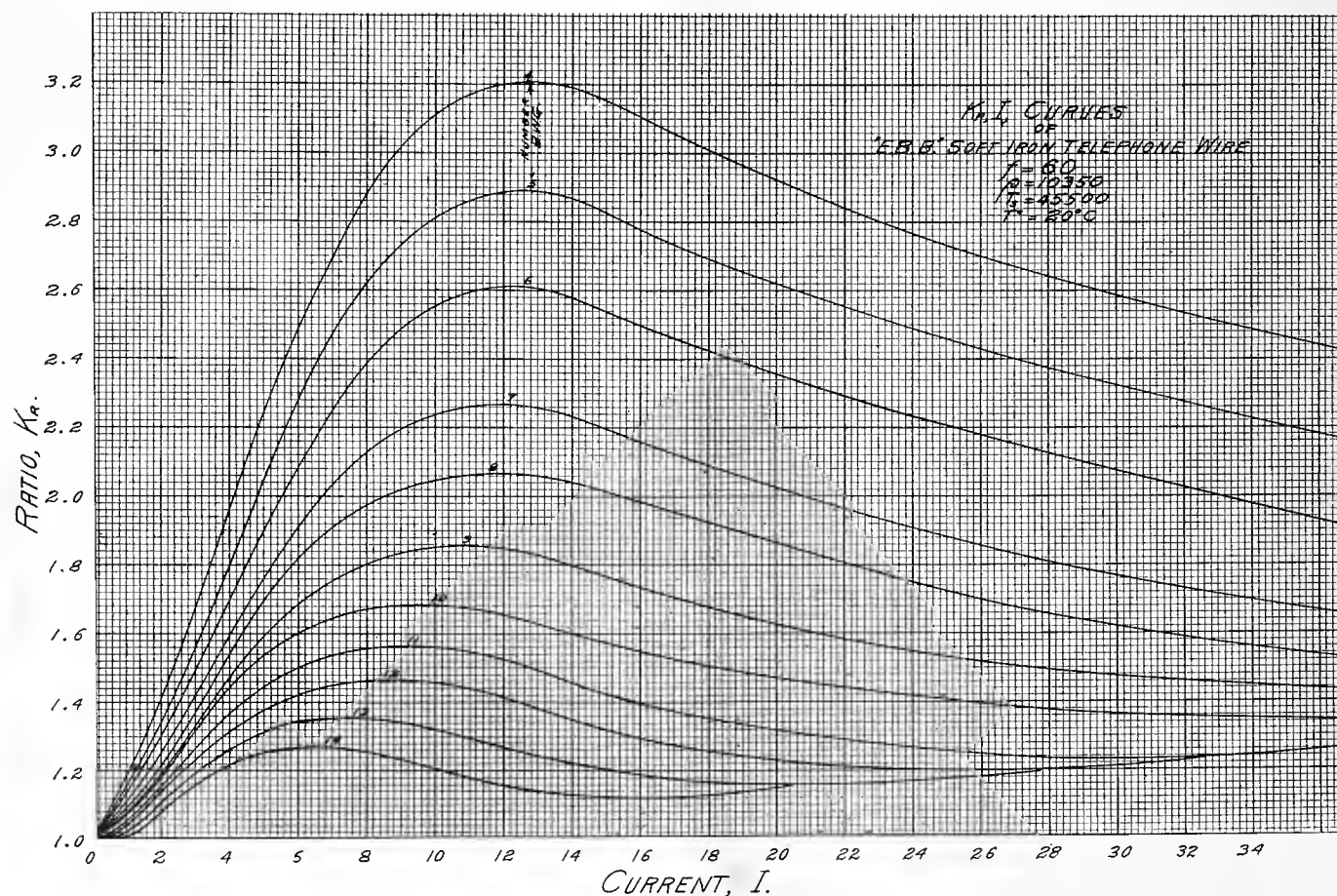


Fig. 13.

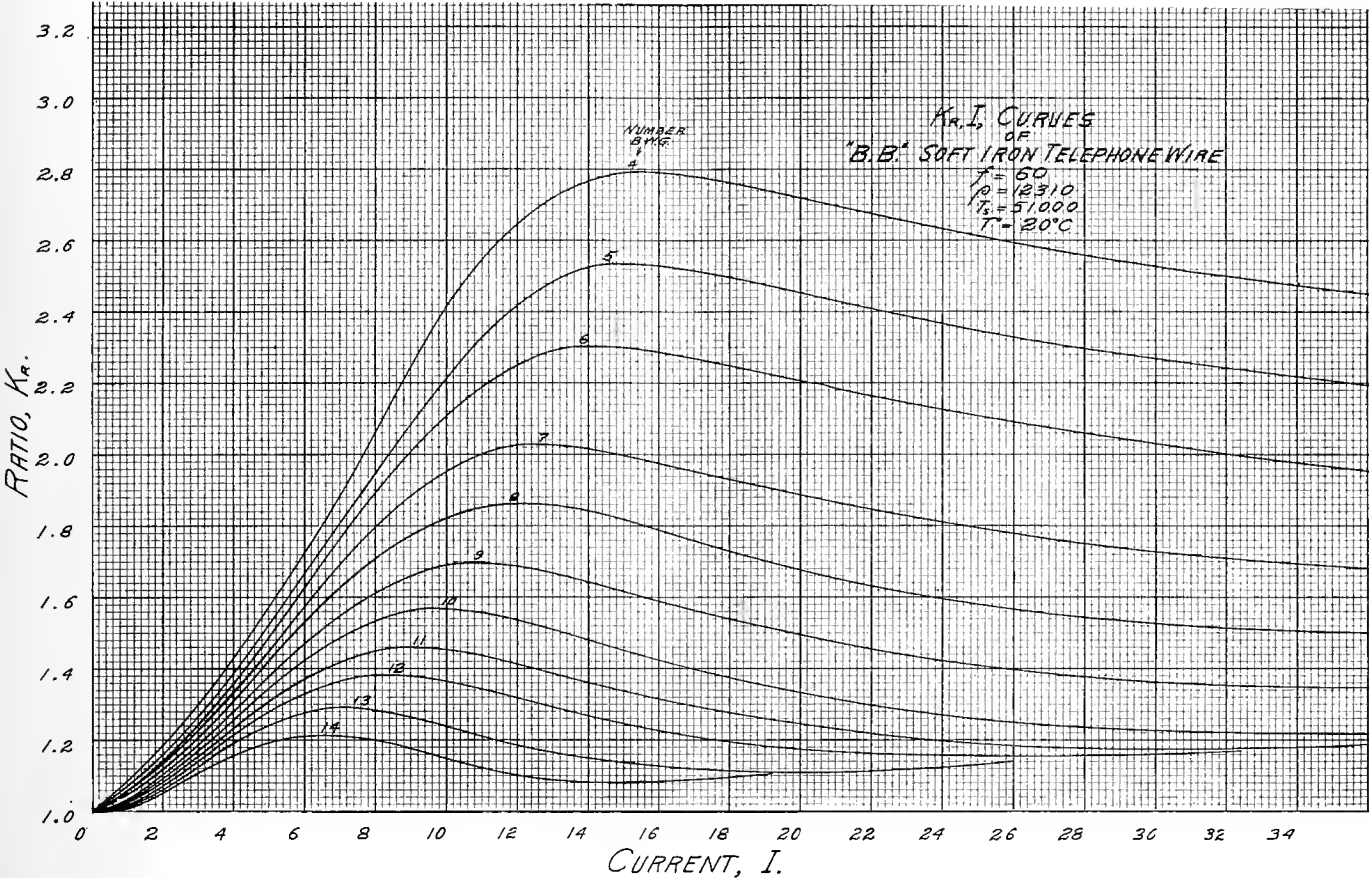


Fig. 14.

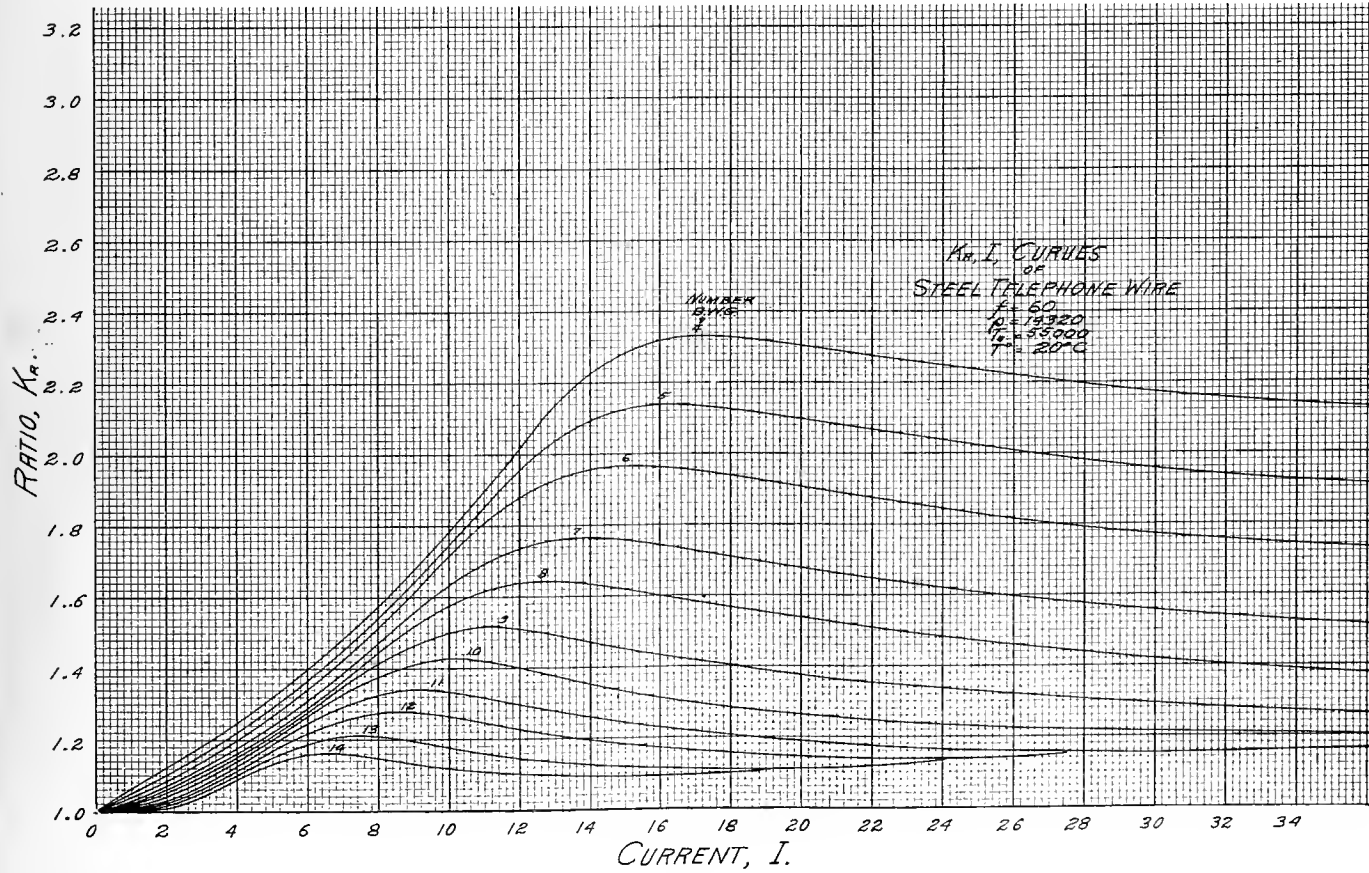


Fig. 15.

For instance, take No. 4 wire and prepare the following table at 60 cycles. The last two columns are of doubtful value.

It is unfortunate that no experimental data except, as given in Fig 8, are available on the high tension steels of from 80,000 to 250,000 pounds per square inch. The table, however, shows a fact noticed before that the higher the tensile strength the lower the resistance to alternating currents of power distribution frequencies, at the currents which would ordinarily be employed. This fact probably holds for all sizes of wire from No. 14 to No. 4.

From these curves it may be calculated that the power factor of the line remains very constant at all values of the current; a fact which has been experimentally verified.

Another apparent 'fact' needing further experimental confirmation is that the (K_z, I) curve varies very slightly as the frequency varies within quite wide limits.

It has also been shown that as the frequency increases L_{iae} becomes more constant so that at about 3000 cycles and higher K_L = about 20 at all frequency currents, sizes and kinds of iron and steel wires.

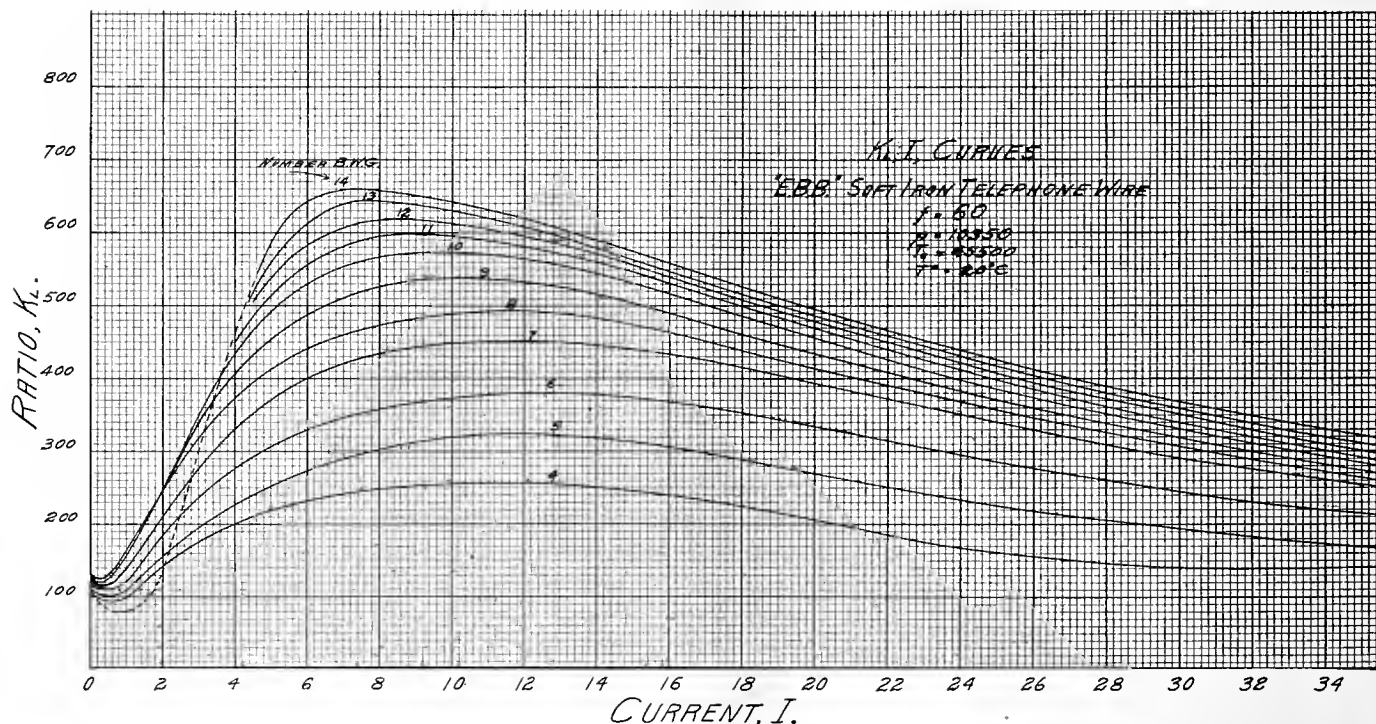


Fig. 16.

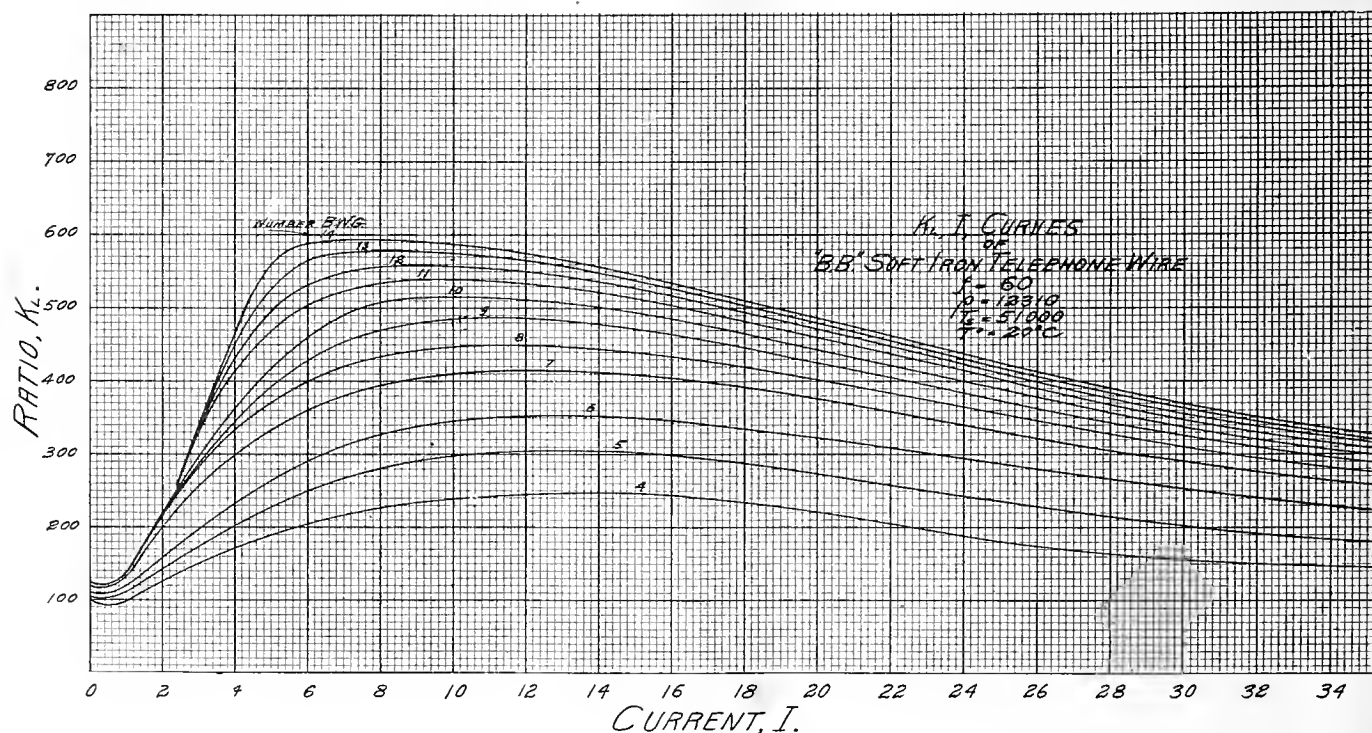


Fig. 17.

This condition is closely approached at 500 cycles. Two important facts militate against the use of iron wire in the place of copper. At low currents the regulation is poor, due to the large variation in K_R for a small variation of current. It would scarcely be economical to use the higher currents where the regulation is good. Furthermore, the curves show that in the case of a short on the line the resistance rises, thus limiting the current to such a value that pro-

TECTIVE DEVICES WOULD NOT OPERATE SO THAT THE SHORT MIGHT BE SUSTAINED SOMETIME, THE CURRENT BEING HIGH ENOUGH TO TAKE THE TEMPER OUT OF THE WIRE. THIS TROUBLE HAS ACTUALLY OCCURRED. Fortunately in the case of steels of above 80000 pounds tensile strength and especially in cables this danger is not so great.

Problem.—The smallest advisable size of E. B. B. iron wire for cross country small power transmission at 60000 volts and 60 cycles is taken as No. 9 B. W. G.

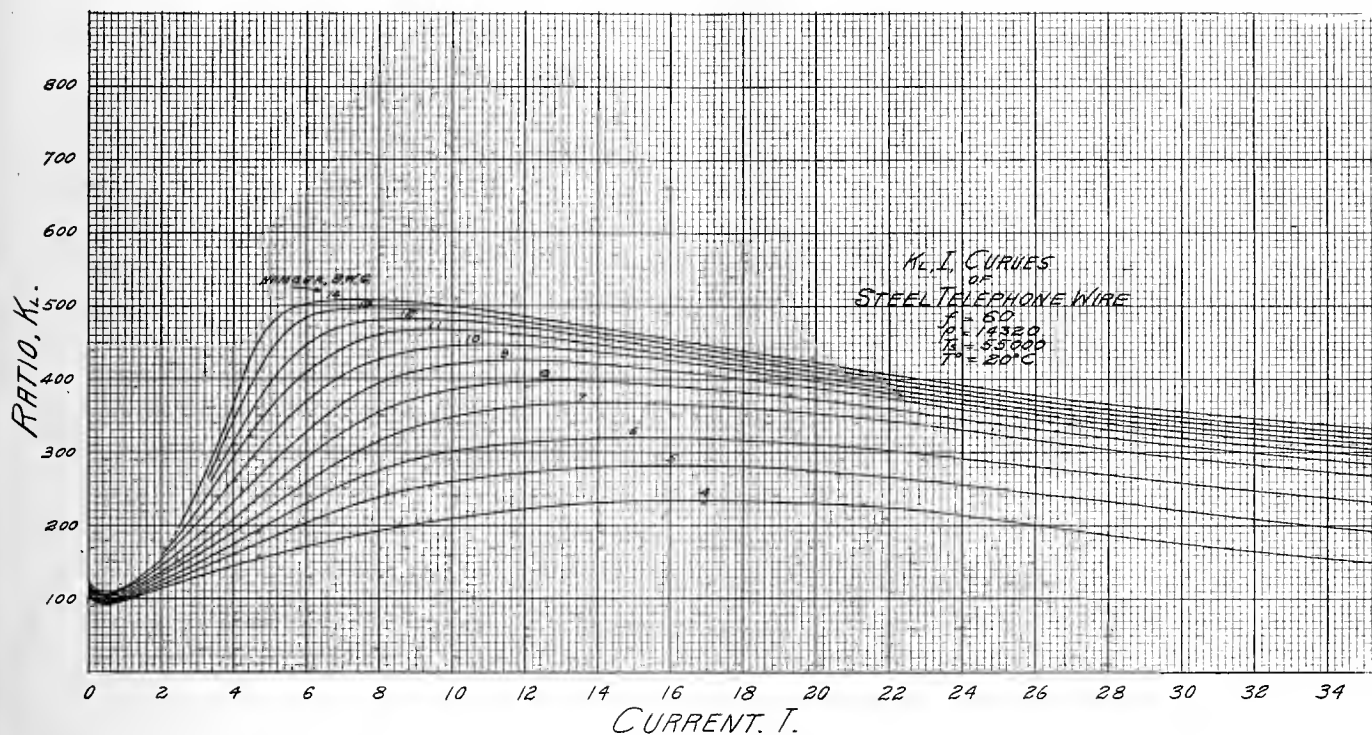


Fig. 18.

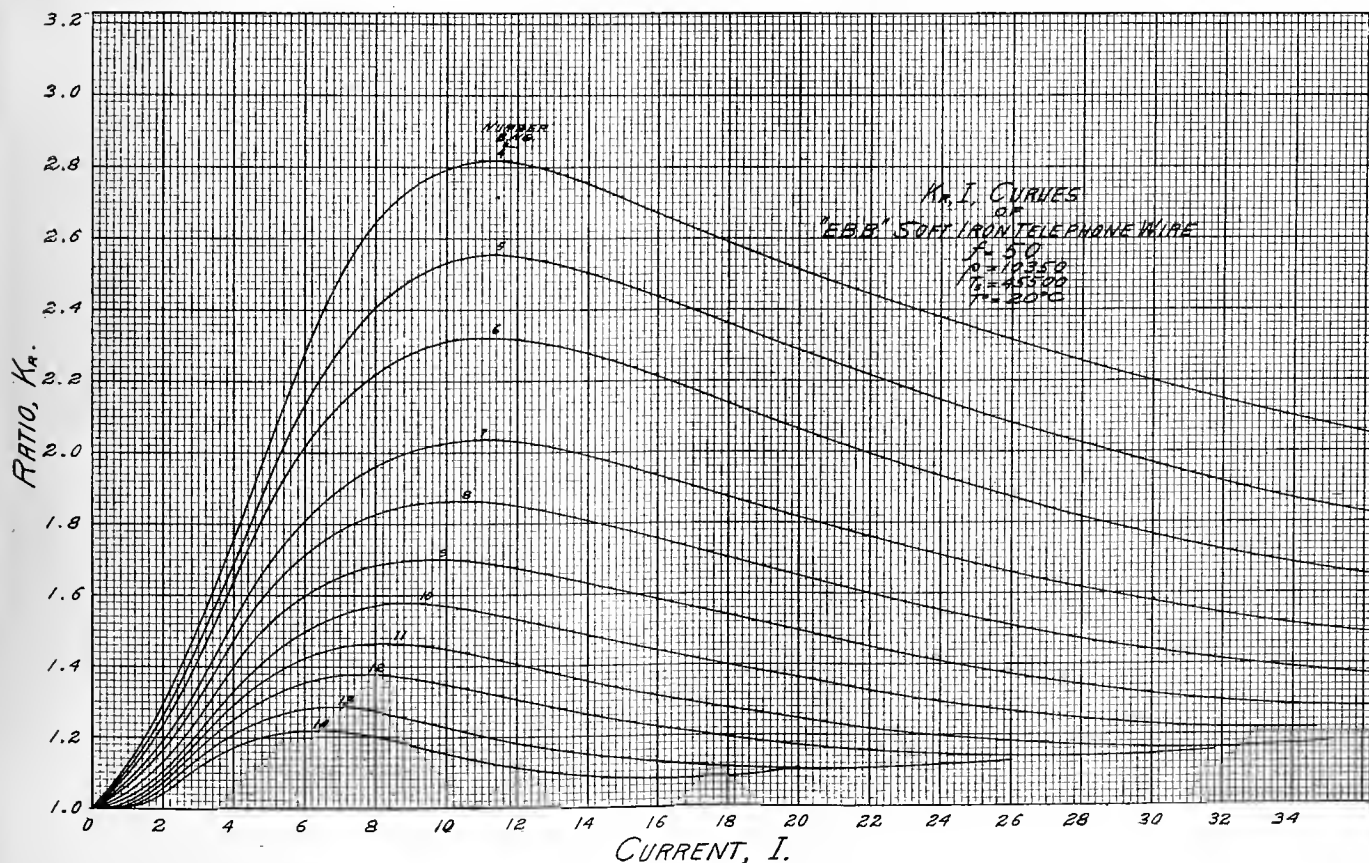


Fig. 19.

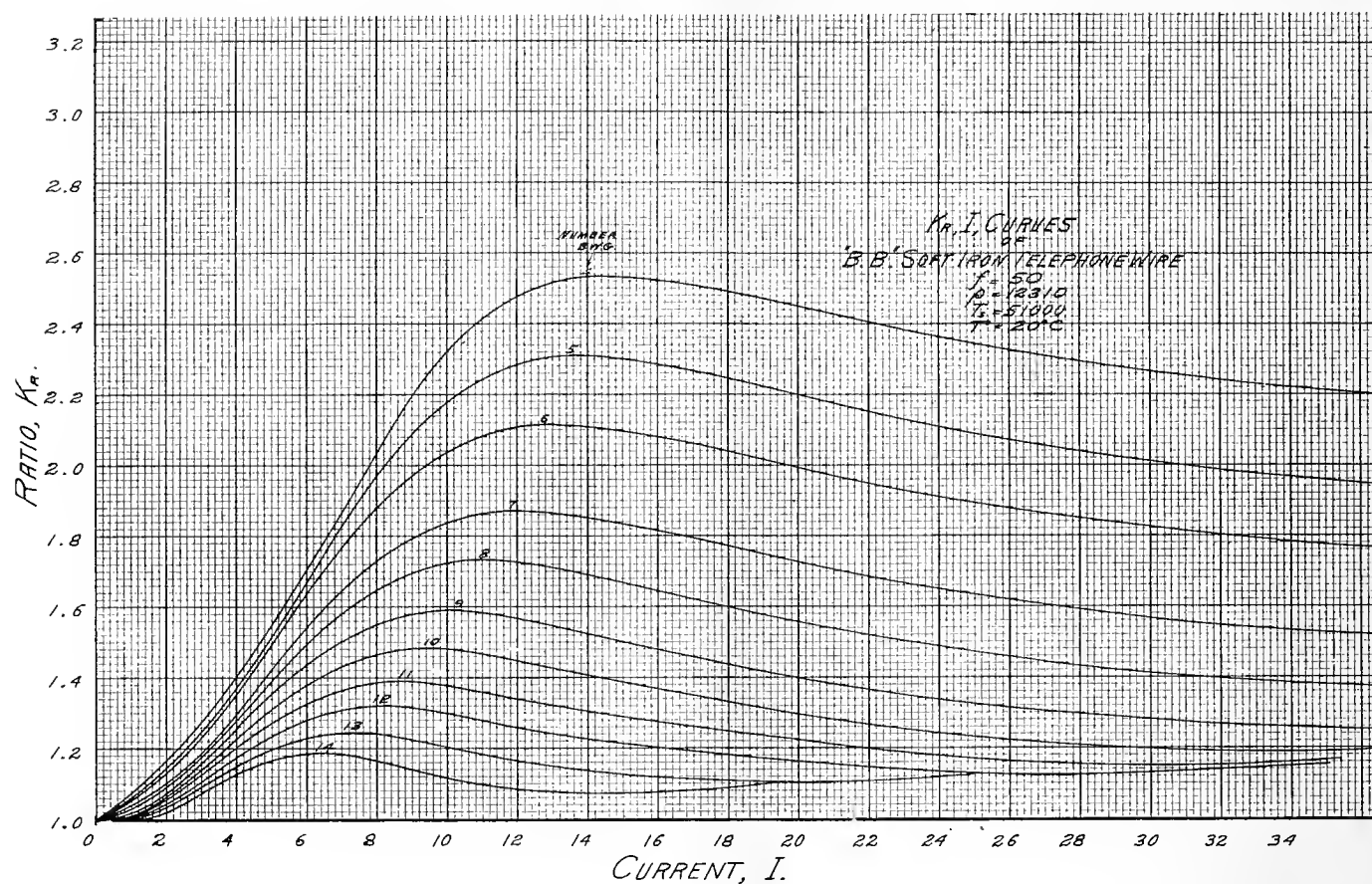


Fig. 20.

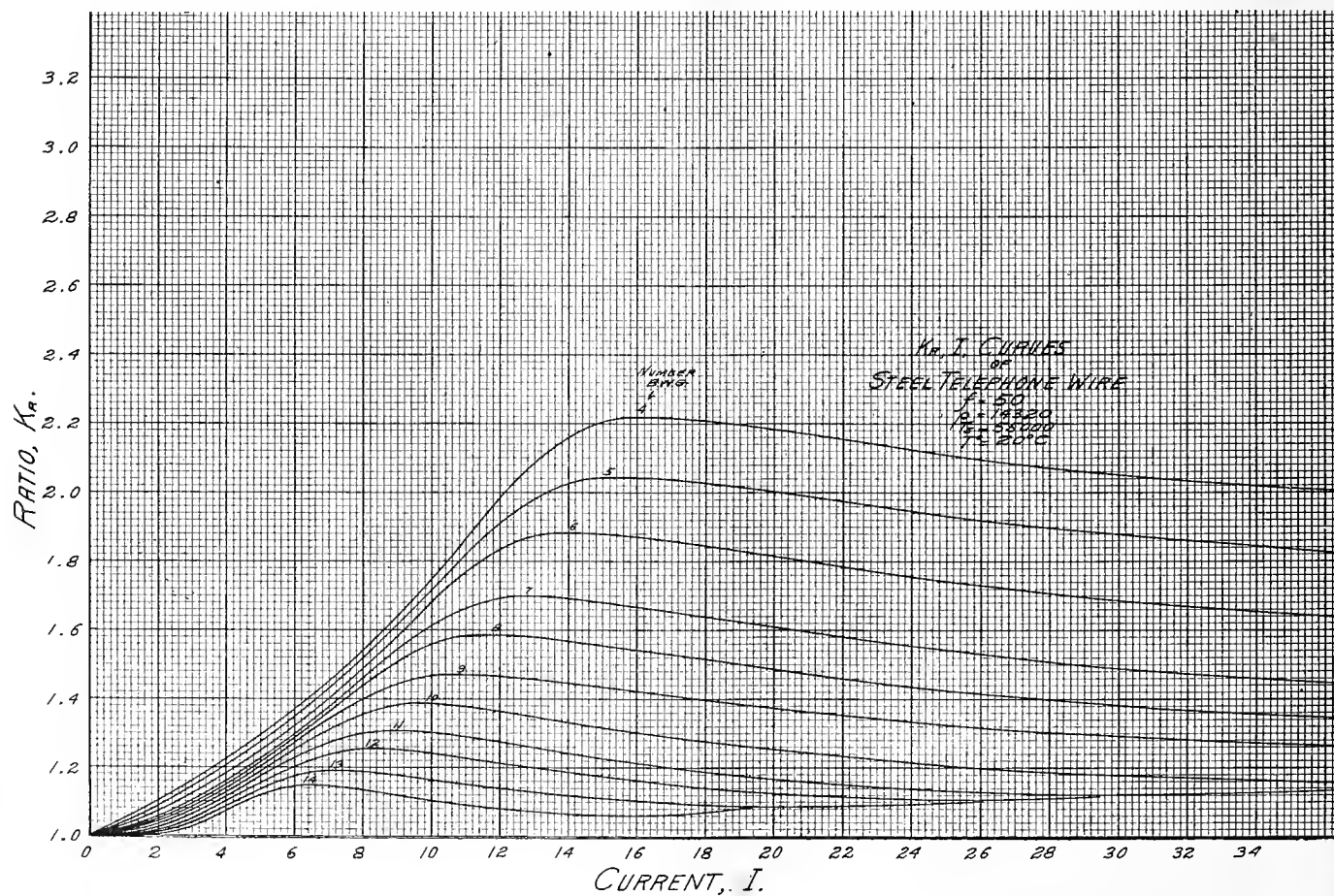


Fig. 21.

At a distance of 10 miles, 366 kw. is to be delivered at 88 per cent power factor. The characteristics of the line are desired, the spacing being 74".

Current, $I = 366,000/60,000 \sqrt{3} \times .88 = 4$ amperes.

From the curves, for E. B. B. wire Figs. 13 and 16 $K_R = 1.473$ and $K_L = 406$.

R_{dc} from Table VI is 2.833.

$$Z_{ac} = \sqrt{(1.473 \times 2.833)^2 + 4 \pi^2 60^2}$$
$$\left(406 \frac{15.24}{10^6} + \frac{140.4}{10^6} \log_{10} \frac{74}{.074}\right)^2$$

= 4.865 ohms per 1000' of each wire.

$I^2 R_{ac}$ loss in the line = 1050 watts.

THE INTERNATIONAL SYSTEM OF ELECTRIC AND MAGNETIC UNITS.

All electrical measurements are based on certain standards kept at the National Bureaus of Standards. These standards represent the units, such as the volt and ampere, in terms of which measurements are expressed. A number of different systems of electric and magnetic units have been proposed from time to time. These systems have been put forward as having noteworthy advantages in a theoretical way over the units which are ordinarily used. A careful study has shown that the advantages of the proposed systems are not such as to justify a general change of units. In fact, the ordinary units are in many ways superior to those proposed.

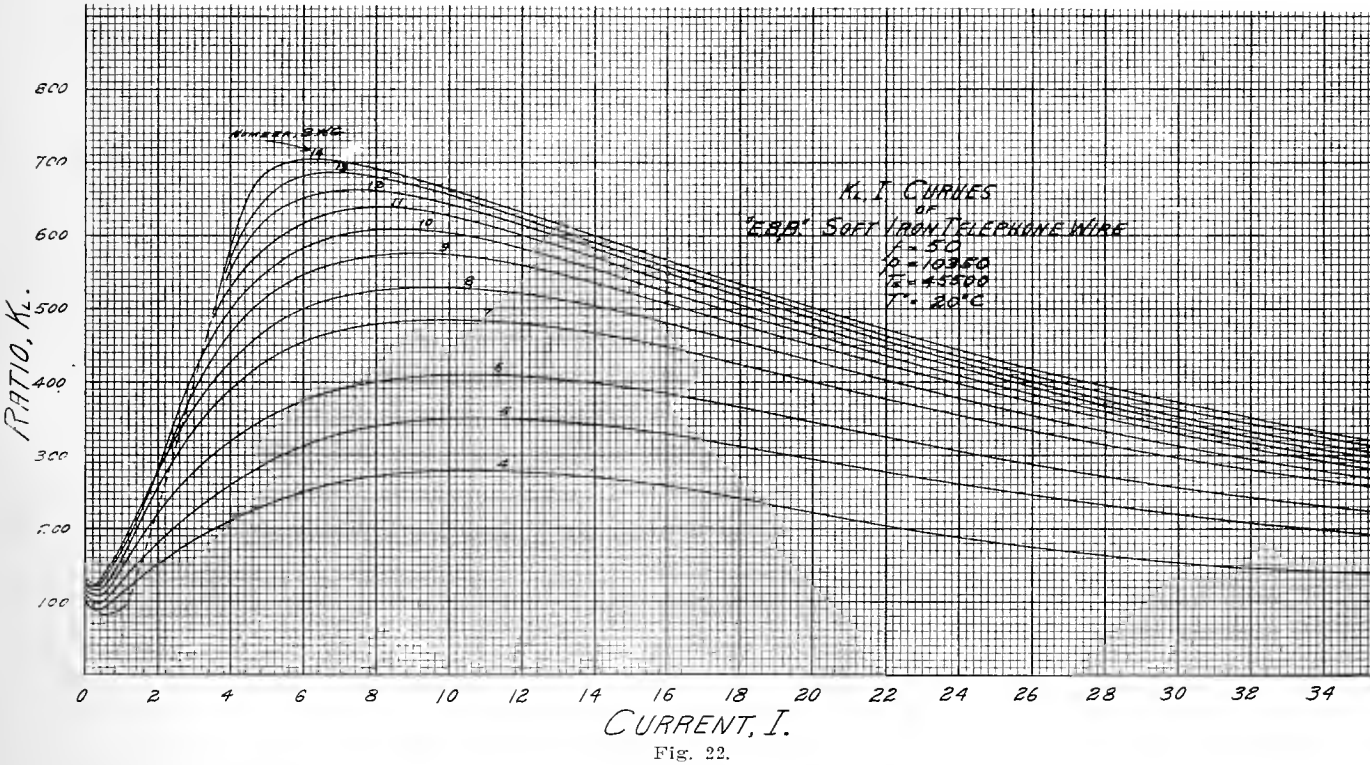


Fig. 22.

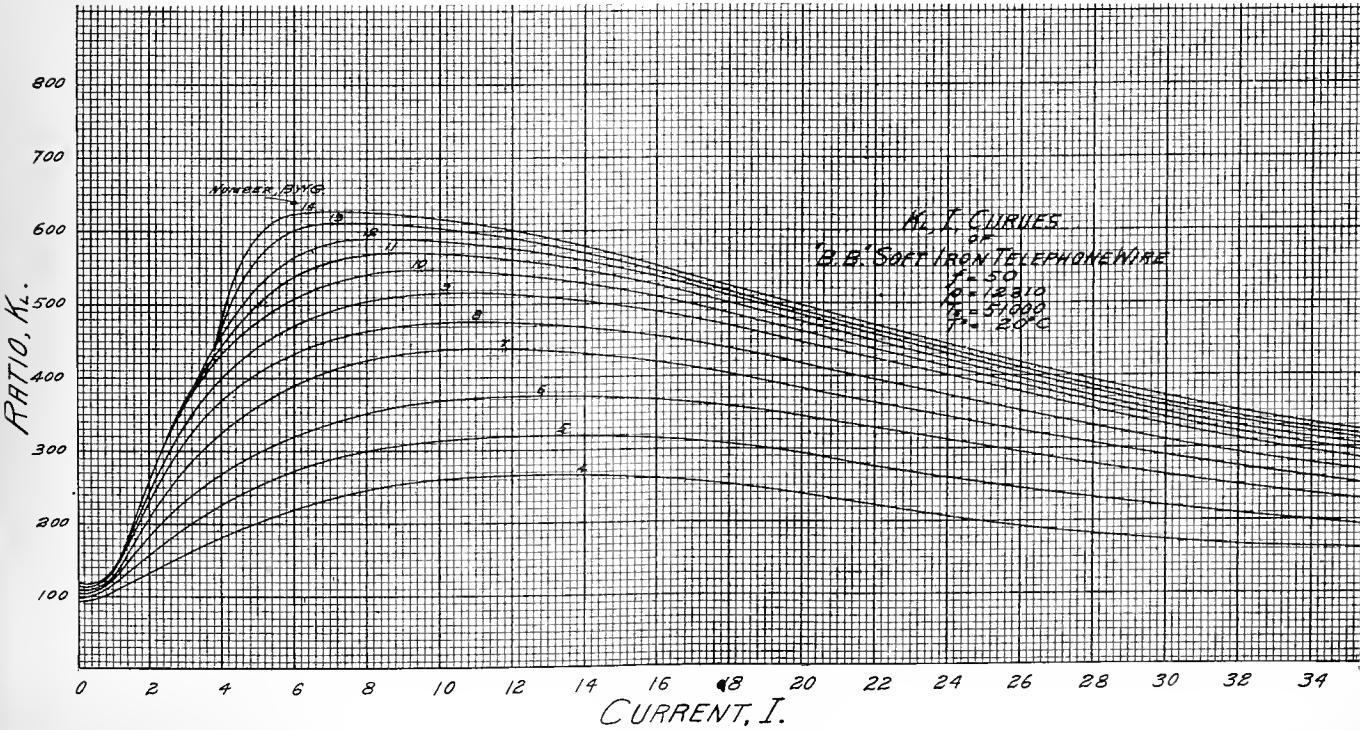


Fig. 23.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

The operation and maintenance of canal systems present problems that are difficult and varied. In the following discussions may be found several important headings that have been gathered from recent field experience.

Cost of Cleaning Canals.

Canal cleaning where water carrying much silt is used is one of the principal costs of canal maintenance. The following results are taken from the 1915 report of R. S. Carberry, the superintendent of the Imperial Water Co. No. 1. The cleaning of 294 miles of canal cost \$102.50 per mile. Clearing 30 miles cost \$68.60 per mile. Cutting brush on 223 miles cost \$34.50 per mile. Disc and grader outfits were used on 307 miles of canal to widen the banks, discourage growths and make roads at a cost of \$20.40 per mile. A canal V was used on 361 miles at a cost of \$81.25 per mile. This is considered to be the best method of cleaning where it is practical. In 1915 the size of the V used was increased and four caterpillar engines used in place of two. Of the total cost per mile \$28 was for the actual V'ing, \$23.50 the cost of repairs to equipment, \$8 the cost of fuel and \$21.60 the cost of Mexican labor following the V. In addition 3 dredges removed 270,000 cu. yds. from 53 miles of canal at a cost of 9½¢ per cu. yd. The system contains 335 miles of canal, the various items mentioned above total 1268 miles. This indicates the conditions of operation on this system where water is delivered throughout the year and requires the working over of each mile of canal by one or the other of these methods an average of 3¾ times. The total cost of these items was \$101,000 or an average of \$302 per mile. For the 108,224 acres irrigated this gives an average cost of 94¢ per acre.

Complaints in Irrigation Operation.

Complaints from consumers under both gravity canals and individual pumping plants are not entirely avoidable. The number can be reduced by the carrying out of well planned systems of delivery and prompt attention to the cause when complaints are made. It is particularly difficult to avoid complaints on large canals serving many farms under the necessary limitations of canal capacity and water supply.

One of the most effectual means of avoiding trivial kicks is to require that all complaints, to be considered, must be filed in writing. This reduces the number materially, as the grounds for complaint do not usually appear as important when reduced to writing and subject to definite verification.

Complaints are of two general kinds, those involving service and those involving costs. Under public utility regulation both service and rates are subject to public control and the company may be relieved of certain complaints which may arise from rules made by such regulatory bodies. Complaints regarding service on gravity systems are usually due to failure to deliver water promptly when scheduled, failure to get a sufficiently large irrigation head and damages from breaks. For individual pumping plants complaints on service may be due to interruptions in the power delivery.

Such interruptions except for very short periods are usually of less frequent occurrence than interruptions on gravity systems following difficult alignment.

The most difficult form of complaint to overcome is that based on favoritism between users whether real or fancied. If users under a canal feel that all are being treated alike and that a fair effort for efficient operation is being made, the majority will not complain over ordinary interruptions. Where a feeling becomes established that favoritism is being shown, co-operation from the users is more difficult to secure and those not favored are alert for grounds of complaint.

Damages for Canal Breaks.

Damage claims for injury due to breaks in irrigation canals or failure of water supply are the cause of many controversies. The liability for such injuries varies somewhat in different states and questions arising in particular cases should be handled as other legal matters. In general canal companies are not insurers and are liable only for such injuries to others as result from their own negligence and the failure to use reasonable care and skill. The care required to be used is that which ordinarily prudent men exercise under like circumstances when the risk is their own. This applies to both general seepage and damage from actual breaks. The burden of proof is usually on the canal owners to show that the canal was properly constructed and operated.

Damages are limited to the actual injury and must be proven by the one injured. The one injured is expected to use reasonable diligence to minimize the resulting injury, and cannot recover for damages which he could have prevented. If land is destroyed, such as by washing away, so as to have no remaining value, the damage may be measured by the value at the time of destruction. If permanently injured but not wholly destroyed, the damages may be measured by the loss in cash value or the difference in value before and after injury. If only temporarily injured the cost of restoring the land to its previous condition may be used to determine the damage. For destruction of growing crops, the damage can be measured by the value of the crop at the time of destruction.

Canal breaks which interrupt service may cause injury to areas served from the canal below the break due to failure to secure their water supply. Where a failure to deliver prevents planting a crop, the difference in rental value with and without water may be used as a measure of the damages. Damages due to a failure to secure water are often covered by the terms of the contract between the canal company and the consumer.

Several of the states have statutes requiring the canal owner to maintain the embankments of the ditches, etc., so that no injury will be caused to others. These provisions seem to emphasize the need of diligence and care more than to change the rules previously stated.

Who Builds Canal Bridges.

In all irrigated states the builder of canals across existing public roads is required to construct the necessary bridges. In Oregon, Nevada and Kansas the laws require the canal owner to maintain the bridge. In Colorado, Idaho, Montana and New Mexico the county maintains the bridge after it is built by the canal owner, usually after a stated period, such as one year, from the date of construction. In the other states provision is usually made for the maintenance by the canal owner unless by act of the county officers the maintenance is taken over by the county. Bridges on main roads at least are more often taken over by the county.

In the case of public roads opened across existing canals, the usual practice is for the county to construct the bridge. The canal owner is required to prepare the right of way so as not to obstruct the road but this does not include the bridge which is a part of the road itself. California statutes provide that no damages shall be given for the right to cross for a road when condemned across a canal.

Power is given to proper county officers to require canal owners to complete bridges across the canal within fixed periods after construction of the canal or after notice from the county. If the canal owner fails to construct the bridge within the time period, it can be constructed by the county and the cost collected from the canal owner.

Where canals cross private roads the arrangement regarding the bridges is usually made a part of the right of way agreement.

Protection of Ditches from Gophers.

Placing a ½-inch mesh galvanized wire in canal banks to prevent gophers burrowing through the bank has been used on the Salt River project according to the Reclamation Record for June. A narrow trench 3 or 4 ft. in depth is dug along the bank of the canal parallel with the canal and from 2 to 4 ft. from the high water mark. The wire is placed in the trench with its top a few inches above the high water line. The depth of the wire depends on the height of fill and size of ditch. Working from either side of the bank gophers are unable to go entirely through the bank because they are not able to cut through the wire. Five hundred feet of badly infested ditch was protected in this way. No breaks have occurred in this length. The cost varies from 20 to 30c per lineal foot, depending on the quality and weight of wire used and material excavated.

Free Boards on Flumes.

The free board which should be allowed on wooden flumes depends on the height of trestle, size of flume and regularity of flow to be expected. Profiles of flumes after one or more seasons' use will generally show variations from a uniform grade of from 2 to 6 inches. This is true even of well built flumes of over 30 or 40 ft. in height, and an allowance for this factor of 4 inches even for flumes on heavy trestles would seem as small as should be used. If the inlet does not bring the water to the flume with a gradually accelerated velocity water actions will take place, the water flowing in surges which may extend for some

distance. These waves are of particular importance in flumes designed for high velocities. In some cases flumes flowing 3 ft. deep with velocities of 6 to 8 ft. per second have been observed to have waves with a difference in elevation between crest and trough of one foot, the difference occurring in less than 10 ft. of flume. For such cases, either the flume can be designed for the mean depth and an excess free board allowed or a value of "n" can be selected sufficiently high to give a depth sufficiently large to cover the maximum depths. Where conditions permit, prevention by careful design of the inlet transition is the best method. For flumes turning across depressions from side hill canals this may be difficult to obtain. The value of "n" in wooden flumes is usually higher for irrigation practice than the figures given in some hand books. The results of experiments indicate that values of less than .013 should seldom be used and that in cases of crooked alignment or worn material the value may be as high as .015. From these various considerations it would seem desirable to allow a minimum free board of 6 in. on flumes 24 in. in depth and an additional amount on larger sizes equal to from 1-4 to 1-5 of the depth.

Cost of Pumping.

The U. S. Reclamation Service had 24 irrigation pumping plants in operation in 1914. The total capacity of the prime movers was 10,472 h.p. divided into 43 units. The lifts varied from 4 to 188 ft. The first cost of the plants was \$785,000. During 1914, 400,484 acre feet of water were pumped. The average cost of all pumping, expressed in cost per acre foot of water raised one foot, was 2.10 cents on the Salt River project; 0.368 cents on the Minidoka project, 1.6 cents on the North Dakota Pumping project, and 0.531 on the Huntley project.

Power Rates on Minidoka Project.

The standard contract rates for electric light and power on the Minidoka project in 1914 were as follows:

	Per kw.-hr.
First 50 hours' use of maximum demand.....	\$0.04
Next 50 hours' use of maximum demand.....	.03
Next 150 hours' use of maximum demand.....	.01
Balance hours' use of maximum demand.....	.005

Above rates increase 25 per cent during June, July and August.

The rates are subject to the following discount:

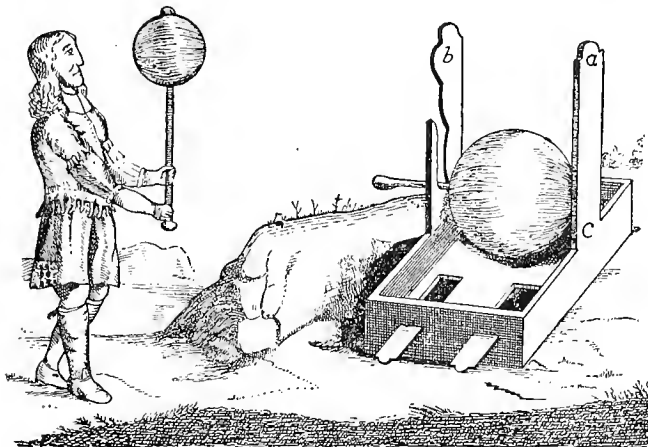
For a maximum demand of	Per Cent.
2 kilowatts and less than 4 kilowatts.....	2
4 kilowatts and less than 7 kilowatts.....	4
7 kilowatts and less than 11 kilowatts.....	6
11 kilowatts and less than 15 kilowatts.....	8
15 kilowatts and less than 19 kilowatts.....	10
19 kilowatts and less than 24 kilowatts.....	12
24 kilowatts and less than 29 kilowatts.....	14
29 kilowatts and less than 35 kilowatts.....	16
35 kilowatts and less than 41 kilowatts.....	18
41 kilowatts and less than 48 kilowatts.....	20
48 kilowatts and less than 57 kilowatts.....	22
57 kilowatts and less than 67 kilowatts.....	24
67 kilowatts and less than 80 kilowatts.....	26
80 kilowatts and less than 100 kilowatts.....	28
100 kilowatts and over	30

The minimum payment shall not be less than \$1.80 per month per kilowatt of the contractor's agreed maximum demand. All the above rates are subject to 10 per cent discount if the energy is delivered and metered at approximately 2,200 or more volts or 8 per cent if delivered at approximately 2200 or more volts and metered at a lower voltage.

COINCIDENCES AND ANTICIPATIONS OF DISCOVERY.

BY A. L. JORDAN.

Bell and Gray filed applications for patents on a telephone receiver within two hours of each other, Feb. 14, 1876; Berliner and Edison invented important forms of telephone transmitters within three months of each other in 1877; Edison in America and Swan in England brought out successful carbon filament incandescent lamps in 1879; patent applications for a compound



Von Guericke's First Electrical Machine in Seventeenth Century.

dynamo were filed by Field, by Edison and by Siemens in 1880, again within three months' time; Tesla, de Ferraris and Dobrowolsky independently invented rotating field motors in 1886; Ferranti in Italy and Colby in the United States, four months apart in 1887, developed the important type of induction electric furnace.

Going back a little, other coincidences were the invention of the electro magnet by Sturgeon (England), and by Henry (America) in 1825 and 1828; the self-exciting feature of the dynamo by Werner Siemens (Germany), and Charles Wheatstone (England), in 1867 (claimed by others, however); Paccinotti in Italy (1864) and Gramme in France (1870) independently developed the ring armature for dynamos; Schiuegger and Poggendorff, working separately, discovered the use of a coil of many turns of wire for a galvanoscope; Elihu Thomson and Fleming invented the inclined coil type of measuring instrument for alternating currents; Schallenger and Tesla (1888 and 89) discovered a method of changing single-phase current to two-phase; finally, Dobrowolsky, Scott and Steinmetz (about 1891-94) found means of changing current of a certain number of phases to current of a different number of phases.

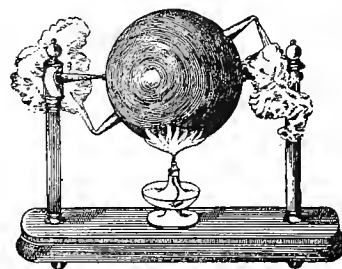
In lines other than electrical, there have been similar coincidences. The law connecting volume and pressure of gases was published by Boyle (in England) in 1862, but was discovered independently by Mariotte in France a short time later. One other well known law, that stating the relation between pressure (or volume) and absolute temperature, was discovered by Charles (France) in 1787, but was rediscovered by Dalton (England) in 1801.

Anticipations have been numerous, but in many cases the man who brought about the commercial de-

velopment of the invention is the one deserving the greater credit. Dollond, who invented the achromatic lens in 1757 was antedated by Hall (1729) but the latter's discovery had been forgotten; Oersted's great discovery of the deflection of a magnetic needle in 1819 is said to have been anticipated at least partially so, by Romagnosi and by Mojon, about 16 years earlier; Ohm's law of resistance, electromotive force and current, published in 1826 had been discovered by Cavendish in 1800; Stephen Gray in the discovery of conductors and insulators (1729) was anticipated by von Guericke (1673); Musschenbroek in his Leyden jar (1746), by von Kleist (1745); D'Arsonval with his moving-coil galvanometer (1882), by Sturgeon (1836); Elihu Thomson with the first successful watt-hour meter (1885), by Ayrton & Perry (1883), in England; Maxim with his famous "silencer" by Elihu Thomson's muffler, patented in 1907; the latter's universally used commutating pole dynamo, patented in 1885, was foreshadowed at least by the "slotted pole" suggestion of Silvanus P. Thompson, years before.

In the history of wireless telegraphy there are several cases of independent discovery. Following Maxwell's remarkable prediction in 1864 of the possibility of waves in the ether came the world-stirring experiments of Hertz in 1888. Then after the famous coherer discovery by Branly in 1890, attention was called to the fact that it had been anticipated by the work of Munk (1835), of S. A. Varley (1852), of Hughes (1878) of Calzecchi-Onesti (1884) and of Lodge (1889). Fessenden in the discovery of the effectiveness (audibility) of musical sounds having about 920 vibrations per second was antedated by Lord Rayleigh.

Lastly, in certain cases, the very name by which the apparatus is known is not that of the discoverer. Hero or Heron, the Greek, whose name is attached to the steam reaction globe (B. C. 150) was evidently only the historian of the appliance, the real discoverer



The First Steam Turbine, About 150 B. C.

being unknown. Wheatstone was not the inventor of the Wheatstone bridge (which he used in 1845) and he freely acknowledged that the credit was due to Christie (1833). D'Arsonval, as has been mentioned, did not invent the galvanometer which bears his name; it was a contrivance of Sturgeon. Ruhmkorff began to manufacture the Ruhmkorff coil in 1851; it was the induction coil of Page (America) in 1836. Venturi had no part in the development of the Venturi water meter; it was brought out by Clemens Herschel in 1888, the name being given in honor of Venturi, the Italian physicist (1746-1822) whose work on discharge orifices or nozzles is well known.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

About 50,000,000 pounds of copper were sold in New York recently at 26½c per lb. What a difference from former prices of 13 and 14 cents.

* * *

Since the beginning of the war the deposits in the banks of Copenhagen have been increasing. The combined balances of its banks now total \$468,000,000.

* * *

Building permits for the first seven months of 1916 totaled nearly \$610,000,000, which is an increase of 29.4 per cent over the corresponding period of 1915.

* * *

The total operating revenues of the Bell telephone system in the United States for the first half of 1916 were \$127,500,000 an increase of \$13,029,000 over the first half of 1915.

* * *

Russian colonists are to be transferred from Riga to South America at the close of the war. It is said these immigrants will be very desirable citizens and possessing sufficient means to finance themselves.

* * *

California is not alone in its efforts to foster the domestic rice industry. The Argentine ministry of agriculture is experimenting on an extended scale with Chinese, Japanese, Italian and Spanish varieties of rice.

* * *

The Australian government is now taking over all rabbit skins for the manufacture of military hats. The highest price paid is forty cents per pound. California ought to develop a new industry and get into the market.

* * *

Reports of the International Institute of Agriculture indicate that the world's crop this year will be less abundant than last, but that harvest prospects are better than the average in the five-year period of 1909-13.

* * *

In spite of the conditions brought on by warring internal conditions, the total foreign trade between Mexico and the United States during the past year was \$119,080,000, an increase of forty per cent over the previous year.

* * *

The average installation of hydroelectric plants at the present time in first cost will amount to not less than \$150 per kilowatt of capacity. A first-class steam plant today, depending on the size, costs from about \$55 to \$75 per kilowatt capacity.

* * *

There has recently been incorporated under the law of the state of Connecticut a new bank known as the "Banco Mercantil Americano del Peru," and having for its purposes the development of trade in Peru and the promotion of trade between that country and the United States.

The Panama canal is practically completed, according to an announcement from the Isthmian canal offices. The great work will cost in all, including fortifications, the sum of \$420,000,000.

* * *

To assist old father time in hastening the hours the Chilean government by official decree has advanced all watches and clocks by approximately sixteen minutes, in accordance with the meridian of the National Astronomical Observatory at Santiago.

* * *

American exports for the year ended with June, 1916, amounted to \$4,345,000,000 and the imports were valued at \$2,180,000,000, making a total foreign trade of \$6,500,000,000, which is much larger than any previous total in the history of American commerce.

* * *

One hundred and thirty thousand maps of the national forests are being distributed to tourists this summer. These maps show the best camp sites, good hunting and fishing grounds, roads, trails, and telephone lines, and give directions how to reach points of interest.

* * *

As an indication of the increased interest evinced by central stations in the work of the Society for Electrical Development, it is announced that recently one hundred and forty-one central stations have become members. The increased membership is representative of all parts of the country.

* * *

The largest oil delivery contract ever made in the history of that industry was recently signed in San Francisco calling for a maximum daily delivery of 50,000 barrels at a cost of about \$18,000 per day. The deal is between the Mexican Petroleum and the Cunard steamship companies.

* * *

The system of propulsion being installed on the "Tennessee," a U. S. super-dreadnaught of the largest and finest class, differs from any now in use by battle-ships. Instead of the propellers being mechanically connected to the driving engines or turbines, there are two steam turbines developing over 33,000 h.p. driving electric generators which furnish current to members.

* * *

The rapidity with which we are progressing in invention is well illustrated by the advance of the telephone. In forty years the Bell telephone companies have invented, used, and thrown away fifty-three styles of telephone receivers and seventy-three styles of transmitters. The average age of all the 12,000,000 telephones in use today throughout the United States is less than five years.

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POWER AND GAS

FOUNDED 1887

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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In the good old days "when knighthood was in flower," if it was desired to capture a walled city, a long beam was rigged up with a heavy metallic end-piece shaped in the form of a ram's head. This was as a rule suspended from a frame and by being swung to and fro was caused to batter against the opposing wall until it finally caved in. Although the first blow hardly ever accomplished the desired result still if subjected to its continual pounding the stronghold of the enemy was sure to fall. And so such a process of consistently pounding away became known as the Battering Ram method of attack.

In the busy commercial life of modern days we can all draw a most useful lesson from the ancients—namely the success bound to come if we consistently apply the battering ram process of attack. This can be most forcefully brought out in modern methods of advertising and especially in methods of window displays for electrical contractor-dealers.

A display of too many different varieties of electrical appliances simply batters against too large an area without accomplishing the results sure to follow if one pounds away at one particular point.

Thus the electrical contractor-dealer who groups his window for a series of days, displaying all about—say flash lights—makes the impression and lands the business. On the other hand, a display of a dozen different articles bearing no relationship one with the other, makes no definite impression and consequently fails to win the commercial campaign desired.

The stone builder desiring to rupture a granite block scarcely ever accomplishes the result in one stroke. In the more usual case many strokes concentrated at the same point are necessary. And when the rock finally ruptures it can not be said that the last effort did the work. It must be admitted that each pounding of the sledge hammer must have contributed its individual share.

This battering ram process has all history back of it for effective results. Try it.

It is generally recognized that one of the few great benefits to the human race that resulted from the horrors of the French Revolution was the birth of the metric system of measurement.

Every Day Use of the Metric System

A hundred and twenty-seven years have passed since that epoch and now the metric system is universally recognized as the one simple, accurate and scientific unit of measurement. Nevertheless, step out into the street and talk to the layman about kilometers of distance or liters of water per hectaire required in irrigation and you get the same glassy stare that comes over the easterner's face when he hears that eggs are selling for two-bits a dozen upon his first western visit.

The practicing engineer is little better. Fundamentally, he understands the metric system of course, but he thinks, works and lives in feet, degrees Fahrenheit, acres, second feet of water, British thermal units, and a horde of other irreconcilable and illegitimate units—complex in themselves but familiar to him because he has been reared in their use.

The English speaking peoples are far behind other nations of the world in putting the metric system first and foremost. The reorganization of the world's trade and the enforced world prominence of America now demand a radical change in this particular. The British public are themselves awakening to the signs of the times. British engineering societies are urging the paralleling of all figures with the metric equivalents and their complete adoption in the near future.

In America the engineering fraternity should take it as a keen rebuff that the National Wholesale Grocers' Association have taken it upon themselves to take the initiative in the printing and labeling of canned and boxed goods with the metric equivalents.

We are all slaves of habit. It took five hundred years to displace the cumbersome Roman numerals for the flexible Arabic system of numbers now in vogue. Let us profit by this experience and each and everyone begin to think more in metric units and at an early date relegate to the scrap heap forever, our ancient and awkward English system of units.

Courtesy, developed to its highest ethical standard, may almost be defined as that divine something which emanates from a human being in such a manner that all life and even nature itself seems to feel at perfect ease. Practically speaking, courtesy is the expression of voice and action so sincere in its effort to reach the other fellow, that the individual possessing it loses sight completely of his own individual selfish interests, thinking only of the common good.

It is remarkable to what extent true courtesy makes for success in modern business life. Its precepts are in these later days being lauded and heralded on all sides and the close observer cannot but come to the conclusion that after all it pays big dividends.

A few years back the claim department of a public utility company largely spent its time in "get to ——" interviews and "go to ——" correspondence. On another page of this issue the head of the claim department of a large western utility company discusses the fundamentals of a modern claim department. Upon its careful perusal the conclusion is soon drawn that courtesy in its highest and truest sense is the most valuable asset on the part of the company's agents in disposing of claims with financial advantage to the company.

The claim agent should ever bear in mind that whether a man has been wronged or not, if he thinks he has been wronged, the harm is there just the same. And courtesy is the great reagent by which such un-

real conditions are softened and finally made to disappear without a scar.

This is only one of the many instances that may be cited where the development of true courtesy proves to be one of the most valuable virtues the modern business man may possess.

We are all weary pilgrims endeavoring with the light that is given us to pass through the land with our full share of success. Let us remember, then, that it is an old saying but a true one—"with hat in the hand we pass through the land."

On another page of this issue is detailed an extensive series of apparent coincidences in discovery and invention. It is a fact often commented upon in every one's personal and business experience of how certain identical solutions to social and business problems often simultaneously suggest themselves to various individuals after independent thought on the part of each. Upon close reasoning we must come to the conclusion that invention is itself nothing but a similar phenomenon. The inventor, familiar with some newly discovered law of physics or chemistry, proceeds to combine in thought this new addition to his mental family of ideas and, if of a practical turn of mind, a useful invention is the result. A second person with similar experience likewise may go through the same mental process and arrive at identically the same useful conclusion.

Not only have simple inventions been thus simultaneously thought out, but even inventions in the most intricate mathematical reasoning have been wrought out independently and simultaneously. Thus Newton, Leibnitz and another famous mathematician, absolutely independent of each other, invented the intricate and deep-reasoning calculus now the foundation stone for modern engineering mathematical reasoning.

The moral to be drawn from all this is that the human brain is a machine of delicate combinations which with careful and thoughtful application we may all train to serve us in the invention of new and practical mechanisms or business methods.

Method in modern business organization and business getting is the great need of the hour. Those who have risen to pre-eminence in business affairs have largely done so by carefully applying the principle of recombining experiences and incidents that have come under their personal notice in order to produce new and more effective methods.

It is now accepted as an historical fact after the comparison of the struggles of great men in their upward course of success that genius is one-tenth inspiration and nine-tenths perspiration.

We all have it in our power, then, to vastly increase our usefulness in the business and social world by quiet and consistent thinking and planning. This is indeed the highest and most useful form of invention.

**Inventive
Genius—
No Monopoly**

PERSONALS

Joseph Sacks, inventor of the "Noark" fuse, is at San Francisco from Hartford, Conn.

H. C. Houck, manager supply department General Electric Company, is at San Francisco.

C. E. Patterson, controller General Electric Company, is at San Francisco from Schenectady.

F. B. Nightingale, salesman with Los Angeles office of the General Electric Company, is at Lake Tahoe.

G. L. Ohman, auditor Portland office General Electric Company, was at San Francisco during the past week.

D. M. Speed, auditor San Joaquin Light & Power Corporation, has returned to Fresno from a trip to San Francisco.

R. J. Cash, manager Los Angeles office General Electric Company, has returned from a trip to Northern California.

A. J. Bowie, Jr., of the Bowie Switch Company, has returned to San Francisco from a trip through Northern California.

E. Darrow, manager Spokane Heat, Light & Power Company, of Spokane, Wash., was at San Francisco during the past week.

W. J. Davis, Jr., Pacific Coast engineer General Electric Company, is making an extended trip through the Pacific Northwest.

F. H. Leggett, Pacific Coast manager Western Electric Company, is attending a district managers' convention at Hawthorne.

H. N. Kiefer has resigned as sales engineer with the Northern Electric Co. Ltd., of Vancouver, B. C., and has gone to New York City.

A. E. Drendell, manager Drendell Electric & Manufacturing Company of San Francisco, is hunting in the wilds of Siskiyou county, California.

E. H. Cheney, sales supervisor Wagner Electric Manufacturing Company, has returned to Chicago after visiting all Pacific Coast cities.

Franklin T. Griffith, president Portland Railway, Light & Power Company, has been elected president of the Portland Chamber of Commerce.

Simon Bamberger, formerly president of the Salt Lake & Ogden Railroad Company, is Democratic nominee for governor of Utah in the coming campaign.

A. H. Halloran, vice-president and managing editor Journal of Electricity, Power and Gas, has been appointed Pacific Coast representative Society for Electrical Development.

A. V. Guillou, formerly extension engineer with the Pacific Light & Power Corporation of Los Angeles, is now district manager in the Porterville office of the Mt. Whitney Power & Electric Company.

R. C. McFadden, formerly with the Puget Sound Traction & Power Corporation at Seattle, has charge of the Pacific Light & Power Corporation's new electric cooking and heating bureau at Los Angeles.

Charles J. Thelen, well and favorably known in electrical supply circles, is closing the affairs of Bill & Thelen and will join the sales organization of the Electric Railway & Manufacturers' Supply Company on September first.

R. G. Hunt, assistant to the vice-president in charge of operation, and **B. W. Lynch**, assistant to the general auditor, are completing an inspection trip to Pacific Coast utility properties managed by H. M. Bylesby & Co.

W. A. Thompson, of the Federal Sign System (Electric), has just returned from completing a five months' sign cam-

paign for the newly re-organized Idaho Power Company. He is now active in the San Joaquin Valley of California.

W. D'A. Ryan, illuminating engineer General Electric Company, will leave San Francisco this week to attend the electrical convention at Seattle, where he will give a lecture on the "Illumination of the Panama-Pacific Exposition."

A. H. Griswold, plant engineer Pacific Telephone & Telegraph Company, leaves San Francisco this week to attend the Pacific Coast convention of the American Institute of Electrical Engineers, where he will present a paper on "Inductive Interference as a Practical Problem."

Harris J. Ryan, professor of electrical engineering at Stanford University, will give the response to the address of welcome and present a paper on the "High Voltage Potentiometer" at the Seattle convention of the American Institute of Electrical Engineers next week.

E. J. Kingsley, recently with the California Telephone & Light Company, and the Pacific Gas & Electric Company in the Santa Rosa, Petaluma and Sonoma districts, has been appointed special representative in Southern California for the Federal Sign System (Electric.)

L. A. Nott has resigned as assistant manager San Francisco office Standard Underground Cable Company, in order to represent a number of factory lines, with particular attention to the K. P. F. Electric Company of San Francisco, where he will make his headquarters.

R. E. Smith, at one time Pacific Coast representative of the X-Ray Reflector Company and recently illuminating engineer for the Pacific Light & Power Corporation, has been appointed sales manager of the Mt. Whitney Power & Electric Company at Visalia. **C. S. Older**, formerly Los Angeles salesman with the Pacific Company, has been transferred to the sales department of the Mt. Whitney company.

S. M. Kennedy, general agent Southern California Edison Company of Los Angeles, **S. V. Walton**, commercial manager Pacific Gas & Electric Company of San Francisco, **H. A. Lennon**, new business manager Truckee River General Electric Company of Reno, and **A. H. Halloran**, managing-editor Journal of Electricity, Power and Gas, leave this week to attend the Seattle convention of the Northwest Electric Light and Power Association.

J. E. Woodbridge, resident manager Ford, Bacon & Davis, at San Francisco, has been elected chairman of the San Francisco Section of the American Institute of Electrical Engineers; **J. P. Jollyman**, engineer electrical construction Pacific Gas & Electric Company, is chairman of the papers committee, and **W. G. B. Euler**, superintendent of operation Great Western Power Company, is chairman of the entertainment committee. The others of the executive committee are **W. J. Davis, Jr.**, Pacific Coast engineer General Electric Company, and **C. A. Turner**, plant engineer's office Pacific Telephone & Telegraph Company. **A. G. Jones**, salesman General Electric Company, has been re-elected secretary.

ELECTRICAL SUPPLY JOBBERS' MEETING.

A meeting of the Electrical Supply Jobbers' Association of the Pacific Coast will be held at Hayden Lake (near Spokane), September 21-23, 1916.

CALIFORNIA STATE CIVIL SERVICE EXAMINATIONS.

The California State Civil Service Commission announces examinations to be held in San Francisco, Sacramento and Los Angeles, on September 23, 1916, to provide lists of eligibles from which to fill the positions of superintendent of construction of the architectural division of the department of engineering, and of assistant state engineer. The salary of the assistant state engineer is \$3000 per annum, (statutory), and that of superintendent of construction \$2400 at commencement, and \$3000 maximum.

CALIFORNIA ELECTRICAL CONTRACTORS' NOTES.

The August monthly meeting of the California Association of Electrical Contractors and Dealers was held at the Hotel Oakland the evening of the 24th. The program was under the direction of the Alameda county section, Mr. Norman Ellis of Oakland presiding.

The greater portion of the evening was given over to the discussion of the various problems of the electrical retail dealer. A greater need of the increase of sales of appliances for the household was vividly set forth by several charts showing low per centage of sales for the quarter ending June 30, 1916. H. C. Kimball of Oakland, Lee H. Newbert and S. V. Walton of the Pacific Gas & Electric Company San Francisco, and C. V. Schneider of Sacramento talked on the subject matter of the charts. Announcement was made of the admission of Mr. A. B. C. Dohrmann of Nathan-Dohrmann, San Francisco, to membership in the association.

Messrs. Lewis of the Fresno Electric Company and Court-right of the Valley Electric Supply Company, Fresno, told of conditions in the San Joaquin valley.

Geo. Sittman presented a paper on the subject of correct percentage for overhead and said it to be his personal opinion that a contractor could not conduct his business properly on less than 25 per cent.

Mr. Louis Levy of San Francisco, speaking from the standpoint of the electrical retail dealer called attention to the variety of prices at which various electrical materials are sold.

Among other speakers of the evening were J. C. Hohrecht, Sacramento; A. Mimema, Electric Appliance Company; D. E. Harris, Pacific States Electric Company; W. S. Berry, Western Electric Company; H. H. Hoxie, Electric Railway & Manufacturers' Supply Co., San Francisco, and W. C. Loveland, representing the electric contractors of San Mateo county, who are about to form a local in their section. It was decided to meet with the latter contractors at an early date and assist them in organization work. The meeting adjourned at 10:00 p. m., some 80 members being present.

NOTES OF CALIFORNIA RAILROAD COMMISSION.

California has established a record of stupendous public utility development under the regulation of the railroad commission. The commission has had jurisdiction over stocks and bonds for four years and five months. During that period it has authorized to be issued \$664,000,000 of securities. Of this amount \$316,000,000 has been for entirely new development; \$181,000,000 has been for the refunding or payment of maturing debts; \$128,000,000 has been for reorganization purposes and the balance has been for collateral and miscellaneous purposes.

Of the \$316,000,000 that has been authorized for new development, more than \$200,000,000 has already been invested, under the commission's jurisdiction, in new public utility undertakings, or is now being so expended. These new undertakings, either actually constructed or now being constructed, have called for capital investment at the rate of \$3,750,000 per month, or \$125,000 for every day that the commission has had its present authority.

This steady flow of capital has come from all parts of the world; from the biggest banking centers of Europe and America; from the largest financial houses and banks of New York, Chicago and elsewhere. Such institutions as J. P. Morgan & Co.; Kuhn, Loeb & Co.; Central Trust Co., of Chicago; Lee Higginson Co. of Boston; and the Continental & Commercial Bank of Chicago are among the list of financial houses of national repute which have been attracted by the investment possibilities of California's public utilities.

The list also includes financial institutions of national scope which had hitherto refrained from investment in Cali-

fornia, including the largest group of investment bankers in the middle west.

During this same period Californians have invested in their public utilities in greatly augmented amounts and increased numbers. The public utilities of the state have added 7000 to 10,000 new stockholders.

At the same time the public utility securities have, by reason of the commission's supervision, become a safer investment for the public's funds.

Under this same jurisdiction of the railroad commission power companies have initiated or carried forward projects embracing 125,000 additional horsepower, at a cost in excess of \$25,000,000.

Among the new railroad developments in California is included:

The Northern Electric, Marysville-Colusa Branch, from Marysville to Colusa, a distance of 22 miles, in the Sacramento valley, costing \$900,000.

The Oakland, Antioch & Eastern Railway, 100 miles in length, connecting San Francisco and Sacramento, costing approximately \$6,500,000.

The Sacramento Valley Electric Railway, a twelve-mile line, from Dixon to a connection with the Oakland, Antioch & Eastern Railway, costing \$250,000.

The gas and electric development has included an expenditure of more than \$75,000,000 under the commission jurisdiction. This development has embraced the establishment of fourteen entirely new companies and the extensive development of the previously established gas and electric companies.

The Pacific Gas & Electric Company, in the San Francisco bay territory and the Sacramento valley; the Great Western Power Company, in the same territory; the Southern California Edison Company, in Los Angeles and surrounding counties; the Pacific Light & Power Corporation, in the same territory; the Southern Sierras Power Company in the southern mountain counties, San Bernardino County and the Imperial Valley; the San Diego Consolidated Gas & Electric Co. in San Diego and vicinity; the San Joaquin Light & Power Corporation, in the San Joaquin Valley; the Mt. Whitney Power & Electric Company, in the lower San Joaquin Valley; the Western States Gas & Electric Company, in Eureka and Stockton, together with scores of other gas and electric companies, have expended \$75,000,000 in development work during the past four years, including the installation of mammoth hydroelectric projects, the extension of distribution systems in all of the cities of the state, and the construction of transmission and distribution lines for agricultural and irrigation purposes in nearly every county in California.

These enterprises have included the construction of great dams and reservoirs. They have been on a scale which has established California's pre-eminence in hydroelectric development.

Every reasonable public utility requirement of the state is met as fast as the necessity arises. Capital is flowing into these California projects in greater volume than ever before.

TRADE NOTES.

Trost Apartments, Twenty-sixth and Howard streets, San Francisco, have been equipped with 42 Westinghouse electric ranges, power being furnished by the Great Western Power Company.

After Oct. 1, 1916 the San Francisco offices of the Westinghouse Electric & Manufacturing Company, the Westinghouse Lamp Company and the R. D. Nuttall Company, will be in the First National Bank Building, where the seventh floor is now being fitted for their occupancy.

The Utah Power & Light Company have placed an order with the Federal Sign System (Electric) for a sign to be installed on the front of the Kearns Building in Salt Lake City, where the company's general offices and the office of

the Salt Lake division are located. The sign is a vertical one and the company's name will be spelled out in full. It will be made of Federal standard 24 in. enameled steel letters surrounded by a border representing a series of fountains. The sign will be seventy-three feet in height over all and will contain 1200 ten watt lamps. The order for this sign was secured by Rufus Johnson, sales representative of the Federal company at Salt Lake City.

The Pacific Gas & Electric Company is putting up a \$150,000 building at Seventeenth and Clay streets, Oakland. The height of the Lake Spalding dam is being raised 35 feet. During August and September the company is paying a bonus to dealers in smaller towns selling gas appliances. This is an experiment to determine whether the dealer can be interested in the matter.

The Lewiston Bear Lake Irrigation Company has awarded to the Salt Lake Hardware Company the contract for the installation of four Allis-Chalmers pumping units of 45,000 gallons per minute total capacity. These units are to be installed on the Bear River two miles west of Fairview, Idaho. The installation, including the pumping station, diversion canal and pipe line will involve an expenditure of \$70,000. The Utah Power & Light Company has contracted with the irrigation company to supply the power required for driving this installation which will have an aggregate connected load of 1400 horsepower. The power will be supplied from the Grace and Oneida plants on the Bear River which are only a short distance from the side of the pumping plant. The plant will work against a head of approximately ninety feet and will deliver the water through a five foot concrete pipe approximately three hundred feet long, which will discharge it into the irrigation canal; 10,000 acres of land will be supplied by the project.

NEW BULLETINS AND CATALOGUES.

The tenth edition of a booklet entitled, *How to Build up Furnace Efficiency*, by Jos. W. Hays, combustion engineer, of Rogers Park, Chicago.

The General Electric Company has just issued Bulletin No. 46201 on Single-Phase Watthour Meters, Bulletin No. 46253 on Polyphase Watthour Meters.

Frederick J. Drake & Company, a publishing house of Chicago have just issued a twenty-five page leaflet setting forth various books carried in stock or practical mechanics for home industry.

The State Highway Commission of Oregon has just issued Bulletin No. 1, entitled *Outline of Road Laws of Oregon*. This outline is primarily intended to facilitate the study of existing road laws with a view to their improvement.

A close-up view of Louise Lovely, the Bluebird Photoplay star, operating the C-H Magentic Gear Shift with which her motor car is equipped, makes a very attractive cover for a four-page two-color folder now being distributed by the Cutler-Hammer Mfg. Co., of Milwaukee.

"Standard Methods of Gas Testing" is the title of circular No. 48 just issued by the Bureau of Standards. Methods are set forth for determining the heating value (or candlepower), purity and pressure of gas supplied and the accuracy of the gas meters in use. The bulletin should prove very helpful to those engaged in gas testing and standardization.

The Bureau of Standards has issued Scientific Paper No. 286 entitled "The Determination of Aluminum as Oxide." This paper gives the results of a research to define the conditions for the determination of aluminum. From observations made with a hydrogen electrode and with suitable indicators, the conditions for the quantitative precipitation of aluminum hydroxide by ammonium hydroxide were determined.

The Bureau of Standards, Department of Commerce, has just published a paper which describes a new form of in-

strument for varying that property of an electrical circuit (self inductance) which opposes any change in the strength of a current, just as the inertia of a heavy train of cars opposes any change in its speed. Copies of this report, Scientific Paper No. 290, are ready for distribution.

The Pelton Water Wheel Company have issued a new publication dealing with Pelton-Doble Centrifugal Pump. While centrifugal pumps have been a product of this company for a number of years, it is only after a careful study of performances that they have decided to place these on the general market. The Pelton-Doble centrifugal pump is rather unique in many features, perhaps the most notable being the uni-diffusion system of the volute. This is a material aid in securing the high efficiencies for which the Pelton-Doble pump is chiefly noted.

It has recently been announced that the Navy Department intends to re-engine ships in the service that are now equipped with direct connected turbines. The first two to be so reconstructed will be the destroyers Henley and Mayrant. These are to be equipped with geared turbine units, for which contracts have been placed with the Westinghouse Machine Company of East Pittsburgh, Pa. Geared turbines have been decided upon due to the fact that they are lighter and take up less space than direct connected units, are much better mechanically because of their small size, and materially reduce steam consumption at all speeds and especially at cruising speeds. This reduces the fuel consumption and increases the steaming radius, which is an important feature.

In a laboratory in which a large number and variety of electrical instruments are tested, it is important that means be provided for the rapid and accurate control of the electric generators which provide the current for testing. In Scientific Paper No. 291 by P. G. Agnew, W. H. Stannard and J. L. Fearing, published by the Bureau of Standards, an elaborate system of this kind which is in use at the Bureau described.

The Bureau of Safety, 72 West Adams street, Chicago, have just issued six excellent sixteen page leaflets entitled *Hazards of Gas Works*, *Fire Prevention in Electrical Stations*, *Think, Heads Up*, *What is Ordinary Care*, *The Spirit of Safety*. Everyone interested in safety should secure a copy of these bulletins as they are issued. A series of helpful shop bulletins are also being published for display purposes in the shops where men are working.

BOOK REVIEWS.

Electrical Motors. By David P. Morton, B.S., E.E.; 4x6 in; 241 pp.; 115 illustrations. Published by Frederick J. Drake & Co., of Chicago, and for sale at Technical Book Shop, San Francisco. Price \$1.00.

This book includes a discussion of electric motors, both direct and alternating, setting forth in a clear, easy manner for the practical man their principles, construction, operation and maintenance. The author is associate professor of electrical engineering at the Armour Institute of Technology. A number of helpful examples are given throughout the book which should prove useful in assisting one to grasp the practical principles that are involved.

Electrical Tables and Engineering Data. By Henry C. Horstmann and Victor H. Tousley; 4x6 in; 331 pp.; replete with tables and illustrative problems. Published by Frederick J. Drake Co. of Chicago, and for sale at Technical Book Shop, San Francisco. Price \$1.00.

The authors of this work have written some ten other similar practical publications. This volume is a book of useful tables and practical hints for electricians, foremen, salesmen, solicitors, estimators, contractors, architects and engineers. In a word the book is an attempt to furnish electricians generally and others interested in electrical work with a reference and table book which can be conveniently carried in the pocket; and as such the book will be found very useful.



NEWS NOTES



INCORPORATIONS.

IDAHO FALLS, IDAHO.—The East Idaho Gas Company has been incorporated with a capitalization of \$125,000. The necessary franchises have been secured and it is planned by the officers of the company to have the gas ready for use in part of the city at least by June 1, 1917, and the plant completed by October 1, 1917. Sixteen people are named as incorporators, 13 of them being Chicago men, and James E. Doyle and W. D. Wilcox, formerly Chicago men, now of Idaho Falls, and A. V. Scott, the local representative on the list of incorporators.

ILLUMINATION.

NEWMAN, CAL.—C. S. S. Forney is making preparations to install a gas system in this city.

TEMPO, ARIZ.—Interest in a municipal electric lighting plant has been revived by the city council.

MELSTONE, MONT.—The question of bonding in the sum of \$6000 for constructing a light plant is being considered.

DOUGLAS, ARIZ.—The city engineer has presented plans and specifications for a new street lighting system to the city council.

LOS ANGELES, CAL.—All bids recently received for lighting fixtures for the Hall of Records by the board of supervisors and new bids will be received up to September 11.

BRAWLEY, CAL.—The city council has awarded a contract to the Holton Power Company for the installation of a street lighting system at \$1500.

PALO ALTO, CAL.—The city council is preparing to call an election to vote on the issuance of bonds for the purchase of the property of the Palo Alto Gas Company.

LOS ANGELES, CAL.—A petition has been filed with the board of supervisors for the establishment of the Athens Lighting District. A hearing will be held on September 11.

LOS ANGELES, CAL.—The city council has ordered ornamental lighting posts and appliances installed and maintained on Hollywood boulevard between Wilcox and Cherokee avenue.

GOLDFIELD, NEV.—The county commission has granted to H. H. Dunbar, on behalf of J. B. Fayant, a franchise for laying mains, connecting pipes and installation of gas reservoirs in Goldfield.

FULLERTON, CAL.—First steps in an effort to secure ornamental lights here have been taken by property owners. A petition to the city council recommends single reinforced concrete lighting standards.

MANHATTAN, CAL.—The Southern California Edison Company has been awarded the contract for lighting district No. 11. The figure for single lights was \$1.10 per month and for clusters \$2.30 per month.

TULARE, CAL.—Fred G. Hamilton, superintendent of the western division of the Mt. Whitney Power & Electric Company, has submitted a proposition to the city trustees for the extension of the street lighting system. The plan calling for the installation of 34 lights, has been referred to the street committee.

YUMA, ARIZ.—The Title Insurance & Trust Company of Los Angeles, as trustee, has taken possession of the properties of the Yuma Electric & Water Company and the Yuma Gas Company and will operate those concerns in the interest of the bondholders. The properties supply the city with light, gas, water and power.

FRESNO, CAL.—The matter of securing estimates for the construction of the electrolier system in the court house park has been turned over to Russel Uhler, county purchasing agent, and the county may install its own lights at a cost of about \$10,000. The system calls for about 100 electroliers, similar to the ones in the city.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has commenced work on the installation of the special street lighting system for Salt Lake City, comprising lighting improvements in district number two, which was recently created by petition of the property owners. The contract for the installation of this system calls for an ornamental standard which is fitted over and around the regular steel trolley poles and completely concealing them. Mounted on the top of this standard is three five-ampere luminous arc lamps of the luminous type. The standards are 100 ft. apart on each side of the street. It is expected that at least one block of the installation will be ready to illuminate at the opening of the festival of the "Salt Princess" which will be held at Salt Lake City, September 11th.

TRANSMISSION.

LOS ANGELES, CAL.—Fire completely destroyed the Pacific Electric hydroelectric power plant in Upland, with a loss of \$20,000.

SEATTLE, WASH.—Martin & Dugan, Northern Bank building, Seattle, are in the market for cables, castings, bolts, turnbuckles, insulators, etc., in connection with the erection of wooden radio masts at North Head, Wash.

KINGMAN, ARIZ.—Geo. H. Thayer, head of the hydroelectric scheme on Burro Creek, has been in Kingman arranging for the acquisition of a franchise for stringing power lines in all towns and mining camps in the county. The company is operating on Burro Creek and has a large number of men at work getting things into shape for building the dams.

OROVILLE, CAL.—Plans for the construction of the second power plant to be constructed by the Great Western Power Company call for an expenditure of \$25,000. The plant is to be located on the north bank of the North Fork, at Smith's Point above Belden. The water will be brought from Lake Almanor in a great concrete aqueduct. The capacity of the new power plant will be 100,000 h.p. To accommodate the increased power, a second tower line from Las Plumas to San Francisco will be built. Work is expected to be well underway in 1917.

TRANSPORTATION.

NEWPORT, ORE.—According to Dr. A. J. Fawcett of this place the Portland & West Coast Railroad & Navigation Company will start construction of its line between here and Portland. It is to be an electrical road.

LINDSAY, CAL.—Work has started at Strathmore on the new extension of the Visalia electric and line running into the El Mirador country. The next move of the electric company will probably be the branch into Lindsay for the routing of which the company is now working out.

SEATTLE, WASH.—The Seattle & Rainier Valley Railway Company is to succeed the Seattle, Renton & Southern Railway Company. New construction proposed by the company will consist of tracks on Dearborn street, from Fifth avenue south to Rainier avenue, and on Fifth avenue south from King street to Dearborn street.

ASTORIA, ORE.—In open competition with the steam line of the Spokane, Portland & Seattle Railway between Astoria and Seaside, the jitney has won. Four local trains on the rail line will be taken off because passengers have left the day coaches for the automobiles. This is probably the first case in Oregon where the jitney has stopped trains.

FRESNO, CAL.—The Fresno Interurban Railway Company, which operates cars from J. and Merced streets to the Academy road above Sanger, has been turned from the construction department over to the operating department. P. N. McCaffrey, construction superintendent for the Mahoney Bros., owners and builders of the line, will be succeeded by W. F. Fuller, formerly superintendent for the Stockton Terminal and Eastern, which operates from Stockton to Linden.

TELEPHONE AND TELEGRAPH.

POMONA, CAL.—The Pomona Valley Telephone Union has closed negotiations which will be followed by the erection of a two-story fire proof building at Third and Louisa streets.

FILLMORE, CAL.—The Pacific Telephone & Telegraph Company is making good its promise for a new system for Fillmore. Work of installing a new switchboard, which is the first unit of the new system, has been started. B. L. Skaggs is in charge of the work.

LONG BEACH, CAL.—The Pacific Telephone and Telegraph Company is making improvements here costing \$26,050, according to the local manager. The work includes the construction of 1300 ft. 8 duct conduit and 14,000 ft. of 600 pair 22 gauge cable on Fifth street between Linden and Alamito avenues, and an aerial cable on Fifth street, between Orange and Fourth street.

IMPERIAL, CAL.—Word from the El Centro Chamber of Commerce is being awaited by officials of the Imperial Telephone Company before ordering the construction of some 50 miles of line between Dixieland and Mt. Springs. The telephone company has had estimates of the cost of line made and has submitted a proposition to the Chamber of Commerce, whereby the line may be maintained partly by the chamber and partly by charges to patrons.

IRRIGATION.

TWIN BRIDGES, MONT.—M. S. Gould was low bidder for construction of a municipal water system at \$28,856.50.

VALE, ORE.—The Warm Springs Irrigation District has voted \$750,000 in bonds for the construction of a dam and improvements to its distribution system.

VANCOUVER, WASH.—The county commissioners have granted permission to the North Coast Power Company to lay large water mains along the river road east of Vancouver.

WILLOWS, CAL.—The petition for the formation of the Princeton-Cordora-Glenn Irrigation District will be presented to the Glenn County Board of Supervisors on September 5.

NORTH YAKIMA, WASH.—The U. S. Reclamation Service has purchased the John Russell ranch, on the Upper Tieton, as a part of the storage basin of the Clear Creek dam at McAllisters Meadows.

EVERETT, WASH.—Articles of incorporation were filed by Washington Coast Utilities Company, with capital fixed at \$100,000. The new concern will supply gas, water, electricity to towns in vicinity of Arlington.

LINDSAY, CAL.—The directors of the Lindsay-Strathmore Irrigation District has voted to award the contract for the construction of the proposed Lindsay Irrigation System to James Kennedy of Los Angeles, his bid being \$1,231,240.

PORT TOWNSEND, WASH.—City Engineer Sadler and his survey crew have made a survey of a route for the proposed extension of the supply for the Olympia gravity water

system, and the data and estimates will be presented to the council at an early date.

EL PASO, TEX.—Water of the Rio Grande will be started through the Electric Butte dam on October 14th. This giant impounding dam forms the largest irrigation reservoir in the world. More than 45 miles in length and eight miles across, the lake stores the melted snows of the Colorado mountains.

HONCUT, CAL.—The project looking to the irrigation of the foothill lands east and northeast of Honcut is progressing favorably. It is estimated at the outset that 10,000 acres would insure the success of the enterprise. This project contemplates taking over the South Yuba system of ditches, enlarging them and adding to their capacity.

DIXON, CAL.—It is stated northern Solano will have an irrigation system in less than two years. The source of water is said to be Cache Creek and Prospect Slough in the vicinity of Maine Prairie with the main ditch running southwest of Dixon towards Winter, Yolo county, which would require one of two lifts operated by powerful pumps.

PORTLAND, ORE.—A water power plant capable of developing about 18,000 horsepower, sufficient to care for all street lighting in Portland for many years to come, is possible on the Sandy and Zig Zag rivers, near Mount Hood, within the Oregon forest reserve, according to preliminary investigations made by the engineers of the water bureau.

RENO, NEV.—Surveyors have practically completed their work at Pyramid Lake, preparatory to the construction of a permanent dam for an irrigation project on the Indian reservoir. An appropriation of \$30,000 was made last year to start the work and supplies and material for the dam have been ordered. The project calls for the expenditure of \$85,000.

WOODLAND, CAL.—The trustees of Reclamation District 1600 have awarded the contract for installing the big pumping plant to the Yuba Construction Company at \$23,147. The plans necessitate the installation of three pumps. The Westinghouse Electric Company was awarded the contract for furnishing two 250 h.p. motors. The Pacific Gas & Electric Company will furnish the power for a term of five years at \$5930.

SALT LAKE, UTAH.—The Lewiston Bear Lake Irrigation Company has awarded the Salt Lake Hardware Company the contract for the installation of four large Allis-Chalmers pumping units of 45,000 gallons per minute. These units will be installed on Bear River about two miles west of Fairview, Idaho. The entire installation, including pumping station, diversion canal and pipe line, will involve an expenditure close to \$70,000.

FORT JONES, CAL.—Farmers of Scott Valley are considering the report of a committee on the law governing irrigation districts. It is proposed to take water from Scott River on the ranch owned by J. J. Fay and convey it in ditch along the east side of Scott Valley to the C. S. Hammond ranch. About 10,000 acres will be covered by the proposed system, which the engineer estimates will cost \$100,000. About one-half of the project is upland soil.

SACRAMENTO, CAL.—The Carmichael Colony Irrigation District sold \$67,600 of the \$90,000 bond issue needed to construct the irrigation plant at what is said to be the highest price ever received in California for the original issue of any district. The first \$22,000 brought par and the remainder sold at \$97.17. The bonds bear 6 per cent interest. Work on the project will commence immediately. It was at first thought \$90,000 would be needed to complete the district, but it was found that because of the great amount of work already perfected by owners, \$57,600 would be ample. Every ten-acre tract in the district will be provided ample water for irrigation purposes.

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Cut-Outs—Each.
Plug—125-250V.

	List.	Sell.
No. 1917 0-30 Amps. D. P. Main.....	.55	.55
No. 1918 31-60 Amps. D. P. Main.....	1.40	1.40
No. 271 61-100 Amps. D. P. Main.....	2.80	2.80
No. 1919 0-30 Amps. D. P. Single Branch.....	.70	.70
No. 1920 31-60 Amps. D. P. Single Branch.....	1.75	1.75
No. 1921 0-30 Amps. D. P. S. or D Branch.....	.65	.65
No. 1922 0-30 Amps. D. P. D. B.....	1.30	1.30
No. 1926 31-60 Amps. D. P. D. B.....	3.50	3.50
No. 1923 0-30 Amps. 3-2 wire D. B.....	1.50	1.50
No. 1927 31-60 Amps. 3-2 Wire D. B.....	4.20	4.20
No. 1924 0-30 Amps. 3P Main.....	.80	.80
No. 1925 31-60 Amps. 3P Main.....	2.00	2.00
No. 272 61-100 Amps. 3P Main.....	4.00	4.00
No. 1926 0-30 Amps. 3P S. P.....	1.35	1.35
No. 1927 31-60 Amps. 3P S. B.....	3.00	3.00
No. 1928 0-30 Amps. 3P D. B.....	2.25	2.25
No. 1928 31-60 Amps. 3P D. B.....	6.00	6.00
No. 1929 0-30 Amps. Single P. Porc. Base.....	.40	.40
No. 1930 31-60 Amps. Single P. Porc. Base.....	.65	.65
No. 1931 61-100 Amps. Single P. Porc. Base.....	1.40	1.40
No. 1932 101-200 Amps. Single P. Porc. Base.....	2.75	2.75
No. 1933 61-100 Amps. S. P. Slate Base.....	.90	.90
No. 1934 101-200 Amps. S. P. Slate Base.....	2.10	2.10
No. 1935 201-400 Amps. S. P. Slate Base.....	5.25	5.25
No. 1936 401-600 Amps. S. P. Slate Base.....	7.20	7.20

600 V.

No. 1937 0-30 Amps. S. P. Porc. Base.....	.60	.60
No. 1938 31-60 Amps. S. P. Porc. Base.....	.90	.90
No. 1939 61-100 Amps. S. P. Porc. Base.....	1.75	1.75
No. 1940 101-200 Amps. S. P. Porc. Base.....	3.00	3.00
No. 1941 61-100 Amps. S. P. Slate Base.....	1.32	1.32
No. 1942 101-200 Amps. S. P. Slate Base.....	2.30	2.30
No. 1943 201-400 Amps. S. P. Slate Base.....	6.00	6.00
No. 1944 401-600 Amps. S. P. Slate Base.....	7.80	7.80

Cut-Outs—Plug.

125-250 V.

No. 62569 S. P. Main line.....	.20	.18
No. 62965 D. P. Main line.....	.30	.30
No. 8020 D. P. Branch S. or D.....	.35	.36
No. 61935 D. P. S. B.....	.30	.32
No. 8042 3-wire S. B.....	.55	.54
No. 62587 D. P. D. B.....	.60	.62
No. 62165 3-wire main line.....	.45	.44
No. 62135 3-wire D. B.....	.90	.90
No. 62199 3 to 2 wire D. B.....	.64	.64

Electric Door Opener

Electric door opener.....	3.00	3.00
Extension Cords.		
6 ft., complete with socket and plug.....	.80	.80
8 ft., complete with socket and plug.....	.85	.85
10 ft., complete with socket and plug.....	.90	.90

The correctness of these suggested selling prices is not guaranteed by the publisher. Suggestions for corrections are invited.

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Cord, Lamp
Cotton Covered, per 1000.

	List.	Sell.
12.....	\$ 85.00	\$ 85.00
14.....	60.00	60.00
16.....	40.00	40.00
18.....	32.00	32.00
18 single conductor.....	22.00	22.00

Cord, Lamp.

Silk Covered, Per 1000.		
12.....	90.00	90.00
14.....	70.00	70.00
16.....	60.00	60.00
18 single conductor.....	40.00	40.00

Cord—Duplex.

Silk Covered, Per 1000.		
12.....	150.00	150.00
14.....	125.00	125.00
16.....	90.00	90.00
18.....	75.00	75.00

Cord, Reinforced Lamp.
Cotton Covered, Per 1000.

12.....	125.00	125.00
14.....	100.00	100.00
16.....	75.00	75.00
18.....	70.00	70.00

Cord

Steel Armored, Flexible.		
18 E.....	100.00	100.00
16 E.....	120.00	120.00
14 E.....	175.00	175.00

Cord

Steel Armored, Flexible.		
18 EM.....	160.00	160.00
16 EM.....	185.00	185.00
14 EM.....	250.00	250.00

Cord

Brewery, Per 1000.		
12.....	75.00	75.00
14.....	60.00	60.00
16.....	50.00	50.00
18.....	40.00	40.00

Cord

Packing House, Per 1000.		
12.....	90.00	90.00
14.....	80.00	80.00
16.....	70.00	70.00
18.....	60.00	60.00

Cord

Asbestos Heater, Per 1000.		
10.....	175.00	175.00
12.....	150.00	150.00
14.....	120.00	120.00
16.....	100.00	100.00
18.....	100.00	100.00

The correctness of these suggested selling prices is not guaranteed by the publisher. Suggestions for corrections are invited.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXVII NO. 11

SAN FRANCISCO, SEPTEMBER 9, 1916

PER COPY, 25 CENTS

SAN FRANCISCO'S ILLUMINATION FESTIVAL.

SKIN EFFECT WITH IRON AND STEEL CABLE.

BY CLEM A COPELAND.

OPERATION EXPENSES OF CALIFORNIA IRRIGATION COMPANIES.

BY S. T. HARDING.

DECISION OF PUBLIC SERVICE COMMISSION OF WASHINGTON ON IRRIGATION RATES.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries

Edison Storage Battery Co.
Electric Storage Battery Co.
Interstate Electric Novelty Co.

Brushes

National Carbon Co.

Boiler Feed Water Treatment

Dearborn Chemical Co.

Conduit Products

Sprague Electric Co.

Electrical Slate

Davis Slate & Mfg. Co.

Electrical Supplies

Pacific States Electric Co.

Feeder Regulators

General Electric Co.

Insulators

Hemingray Glass Co.
Pierson, Roeding & Co.
Locke Insulator Mfg. Co.

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Century Electric Co.
General Electric Co.

Oil Circuit Breakers

Westinghouse Electric & Mfg. Co.

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Pittsburg Piping & Equipment Co.
Pierson, Roeding & Co.

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UNIVERSAL Electric Home Needs

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The public knows the high quality and worth of the merchandise you offer.

A factory that will make good stands back of the guarantee on every article.

A fair profit and satisfied customer.

Ask us for display equipment and selling helps. They will cost you nothing and increase your sales.

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

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SAN FRANCISCO SEATTLE

Address our nearest house.



Hot dipped galvanized pole line construction material.

Glass and porcelain insulators.

Wood insulator pins and brackets.

Galvanized and black enameled rigid iron conduit.

Rubber covered, weather-proof and bare copper and iron wires.

Porcelain knobs, tubes and cleats.

Non-metallic flexible conduit.

Insulating materials of all kinds.



BAKER-JOSLYN COMPANY

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911 Western Ave. San Francisco 353 East Second St.
Seattle Los Angeles

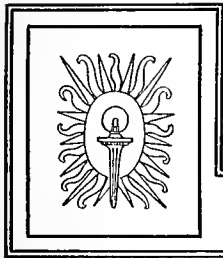


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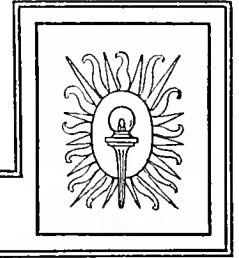
Monterey Bay Points
Lake Tahoe
Sierra Resorts
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JOURNAL OF ELECTRICITY

POWER AND GAS



Devoted to the Conversion, Transmission and Distribution of Energy

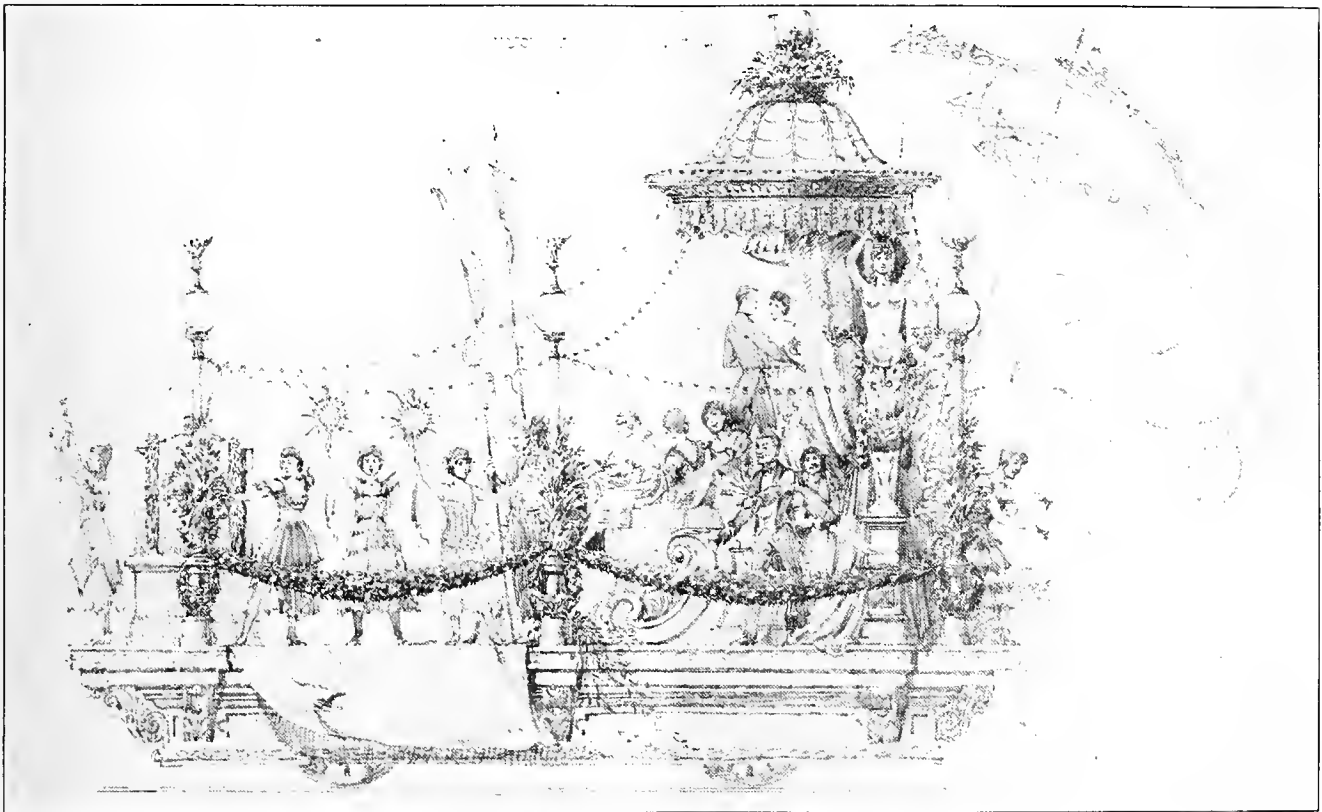
VOLUME XXXVII

SAN FRANCISCO, SEPTEMBER 9, 1916

NUMBER 11

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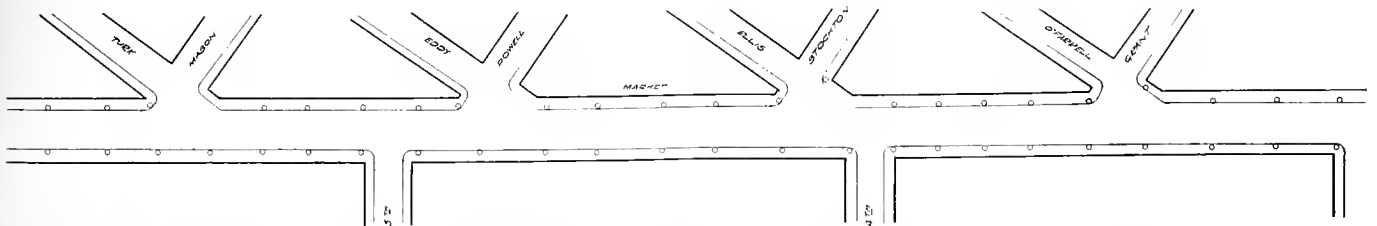
SAN FRANCISCO'S ILLUMINATION FESTIVAL



Modern Electric Lighting.

To celebrate the completion of the first section of San Francisco's new scheme of street illumination, a great electrical pageant is to be held on October 4th and 5th. Market street, the city's main thoroughfare, will then for the first time be lighted by luminous arc lamps on ornamental standards, such as were employed at the Panama-Pacific Exposition. At the same time the new city hall is to be dedicated, so that plans are being laid for a great carnival.

The most spectacular feature of the festival is to be an illumination parade with floats emblematic of the history of lighting from the time of the cave man down to the present. Through the courtesy of W. D'A. Ryan, the originator of this method of lighting and under whose direction the main floats are being constructed, illustrations are here shown of many of these floats, together with the accompanying standard bearers. These pictures are self-explanatory and of



Map of San Francisco's Business District, Showing Location of Beautiful New Lighting Effects.



Cave Man.



Assyrian.



Egyptian.



Greek.



Roman.



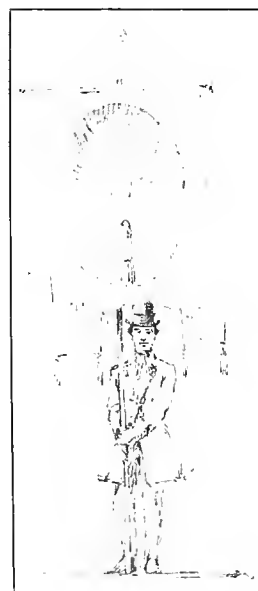
Middle Ages.



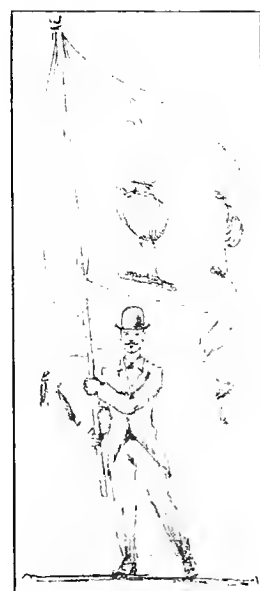
Renaissance.



1790, French.



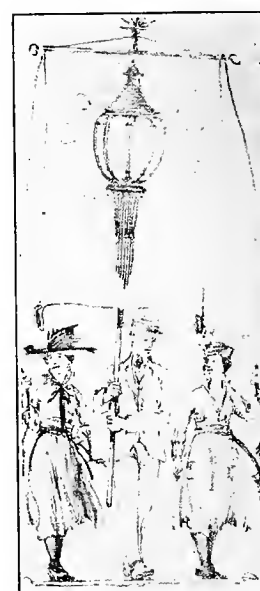
1850, Gas.



1870, Oil Lamp.



Marine.

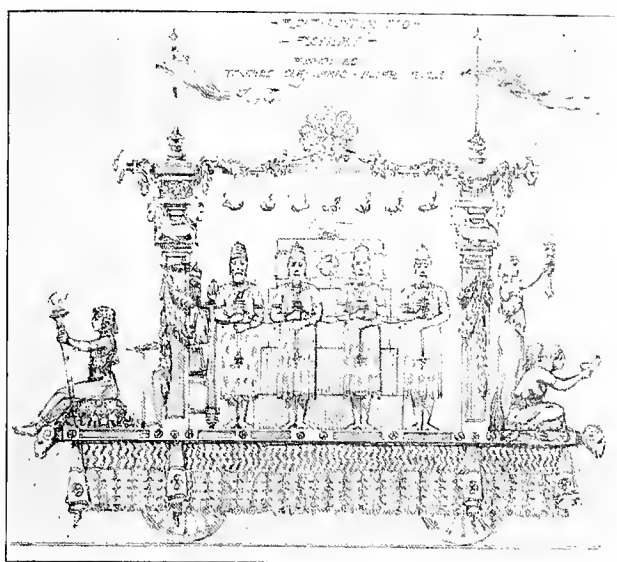


Modern.

The Evolution of the Modern Electric Lamp.



The Cave Man, with Burning Pine Knot.



Assyrian, with Torch and Clay Lamp.

special interest to electrical and illuminating engineering as depicting progress in the science and art of illumination.

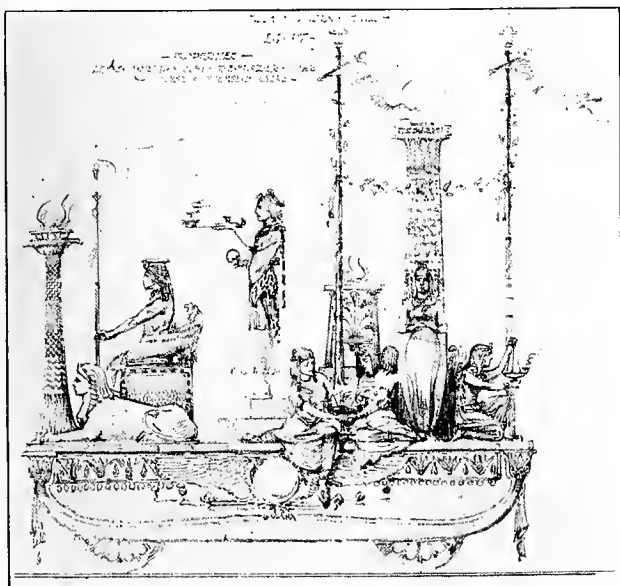
These floats are only a part of the pageant which is being arranged under the auspices of the Downtown Association by many civic organizations, including the Electrical Development and Jovian League. The parade committee of this latter organization has already provided twenty-one additional floats, headed by an animated representation of the Aladdin poster, which is to be featured during America's Electrical Week, December 2-9. Another notable float will be that of the Nela laboratories, showing a 30 ft. transparency of the Exposition at night, flashed by the Market street standards.

Other features include thousands of marchers, all in costume, and each carrying some form of light. Time magnesium flares will facilitate the taking of moving pictures; special fireworks will be provided, and the street will be decorated, prizes being awarded the best building fronts and display windows. The entire affair will partake of the nature of a Mardi Gras,

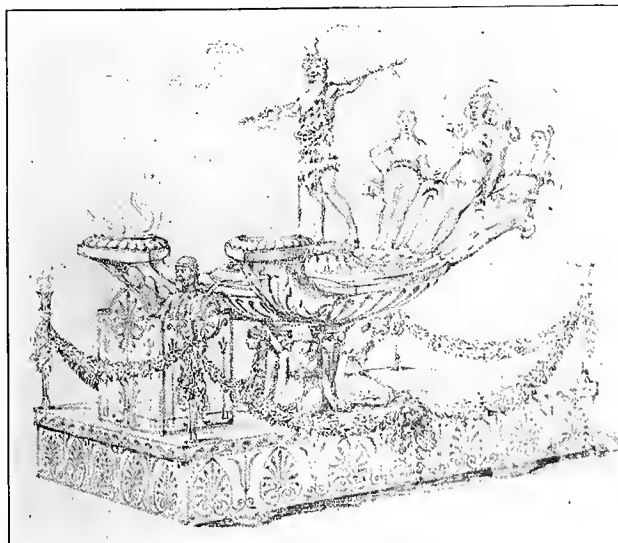
and because of special rates offered by the railroads from all Pacific Coast points, is expected to attract large crowds from out of town.

The initial installation, which is then to be made the occasion of a lighting festival, extends for about 1½ miles along Market street, from the Ferry building to Seventh street. Three-light standards, 32 ft. in height, are placed at 110 ft. intervals. These standards consist of iron trolley poles surmounted by three General Electric ornamental luminous arc lamps. The standards were designed by Willis Polk, and modelled by Arthur Putnam and Leo. Lentelli. The finish is imitation bronze. The lamps are arranged as a triangle with plane transverse to the street.

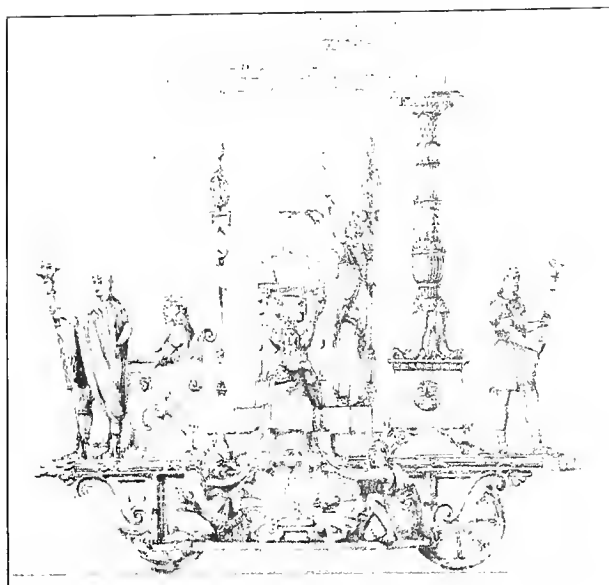
The lamps are those used at the Panama-Pacific Exposition, with a new sectional globe of "San Francisco Gold Carrara glassware," specially made by the Gleason-Tiebout Company in collaboration with W. D'A. Ryan. The appearance is less obtrusive than the usual white or opal glassware, and, by day, gives the name "Path of Gold," which has been adopted for the lighted area. This glassware has but little greater absorption than white Carrara of the same diffusing



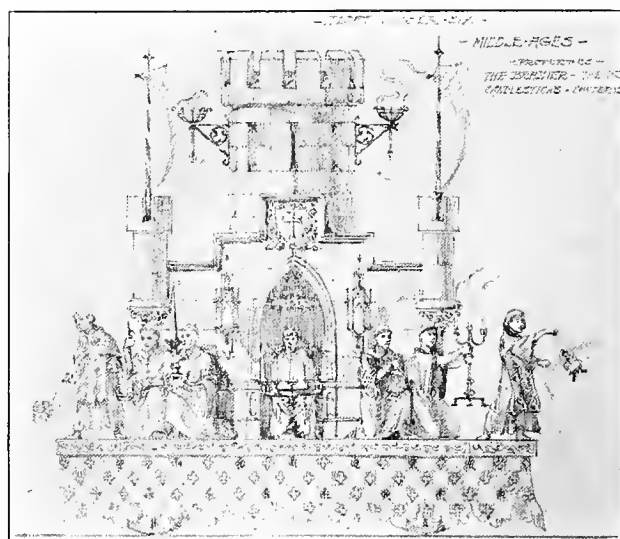
Egyptian, with Lamp and Brazier.



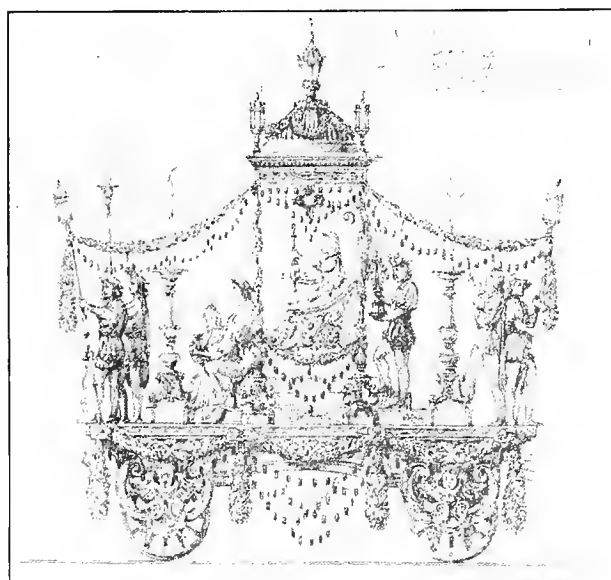
Grecian, with Decorated Bronze Lamp.



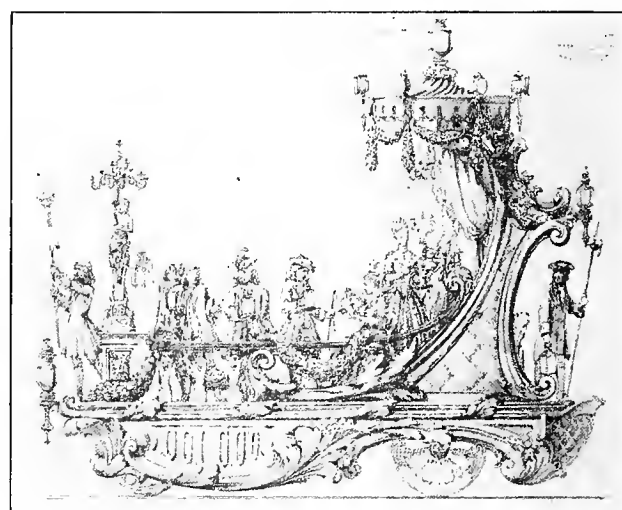
Roman with Candelabra.



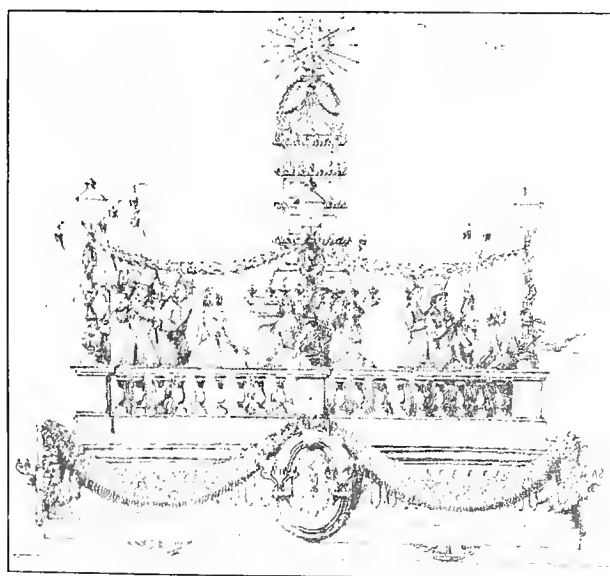
Middle Ages, with Candle, Lantern and Braziers.



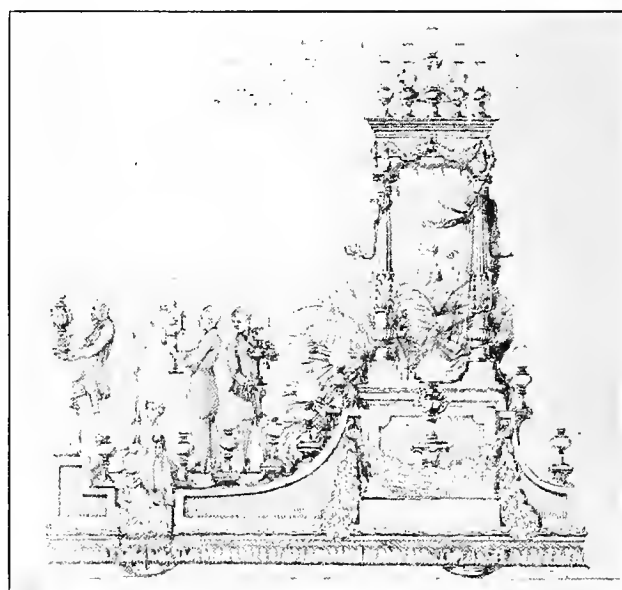
Italian Renaissance, with Festooned Oil Cups.



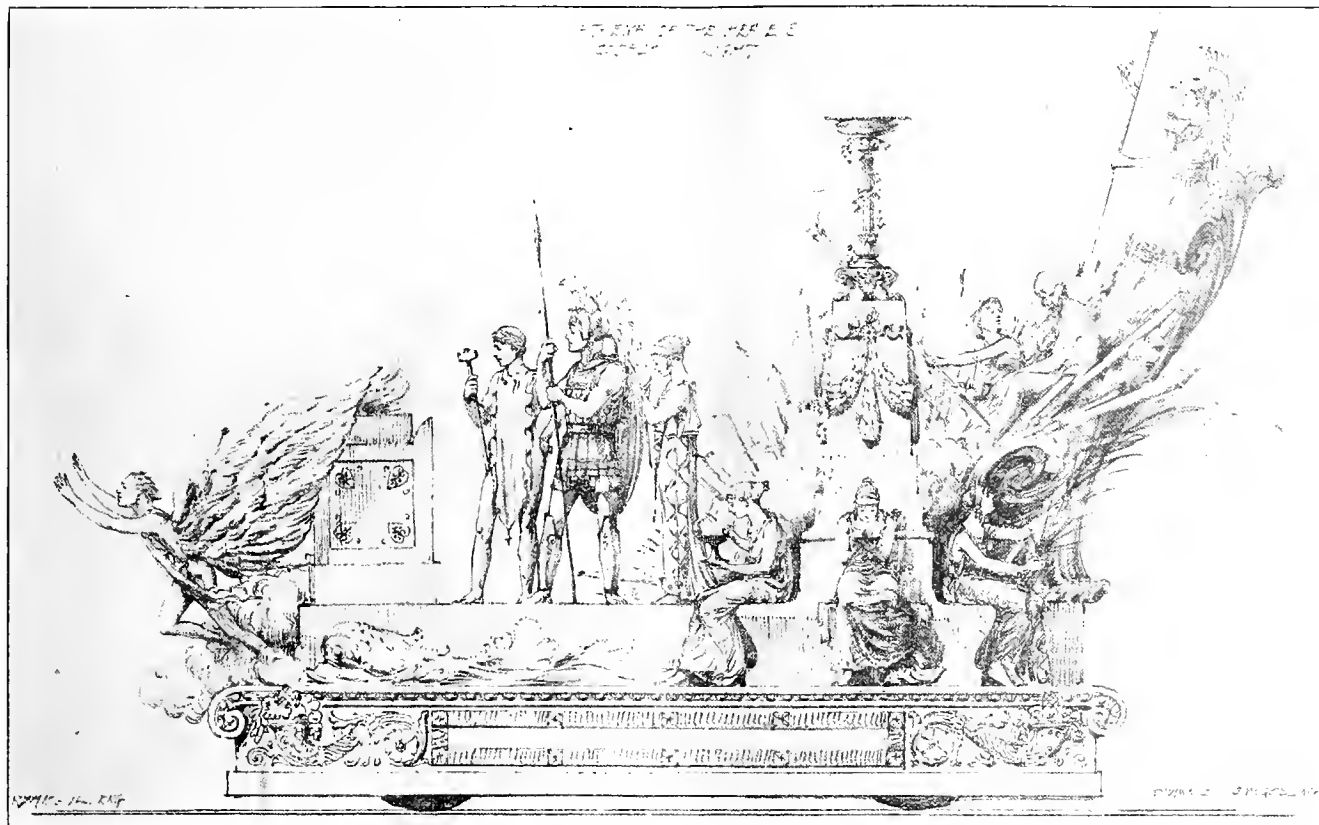
Eighteenth Century, French, with Hand Lanterns and Wall Brackets.



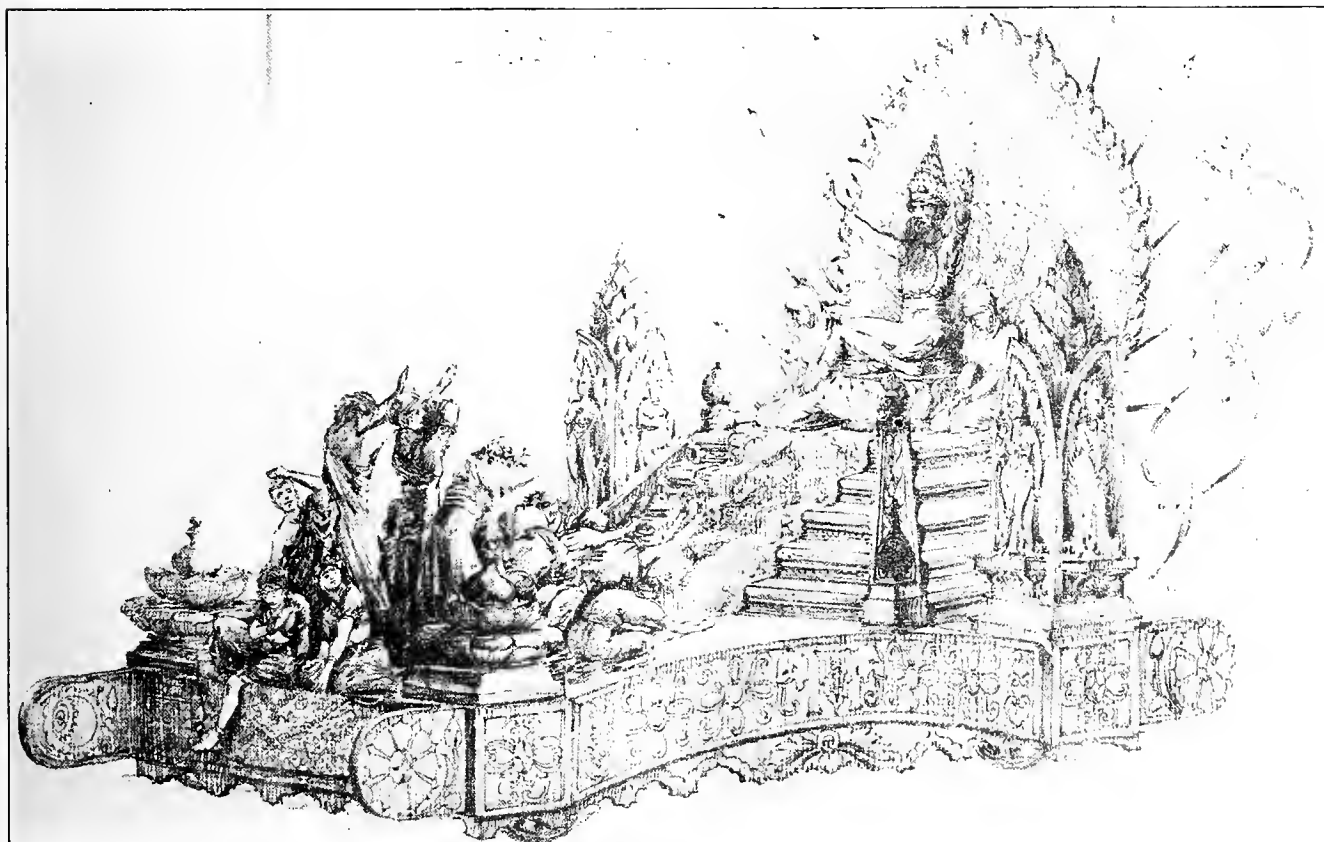
Period of 1850, with Early Gas Fixtures.



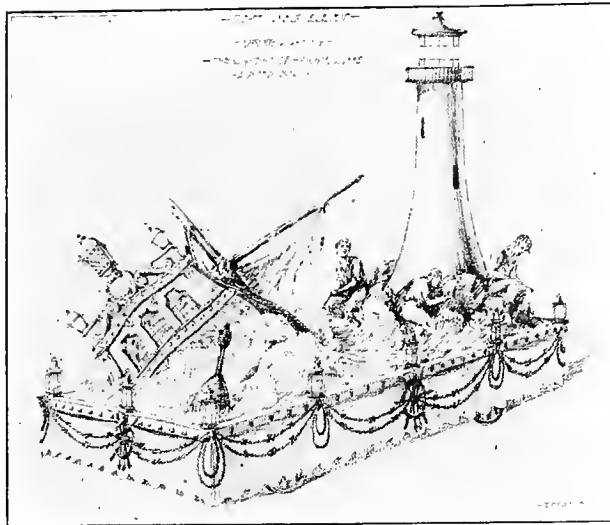
Period of 1870, with Oil Lamp and Calcium Lamp.



Athena of the Heavens, Goddess of Light, Representing the Arc.



Mazda, The God of Light, Representing the Incandescent.



Marine Lighting.

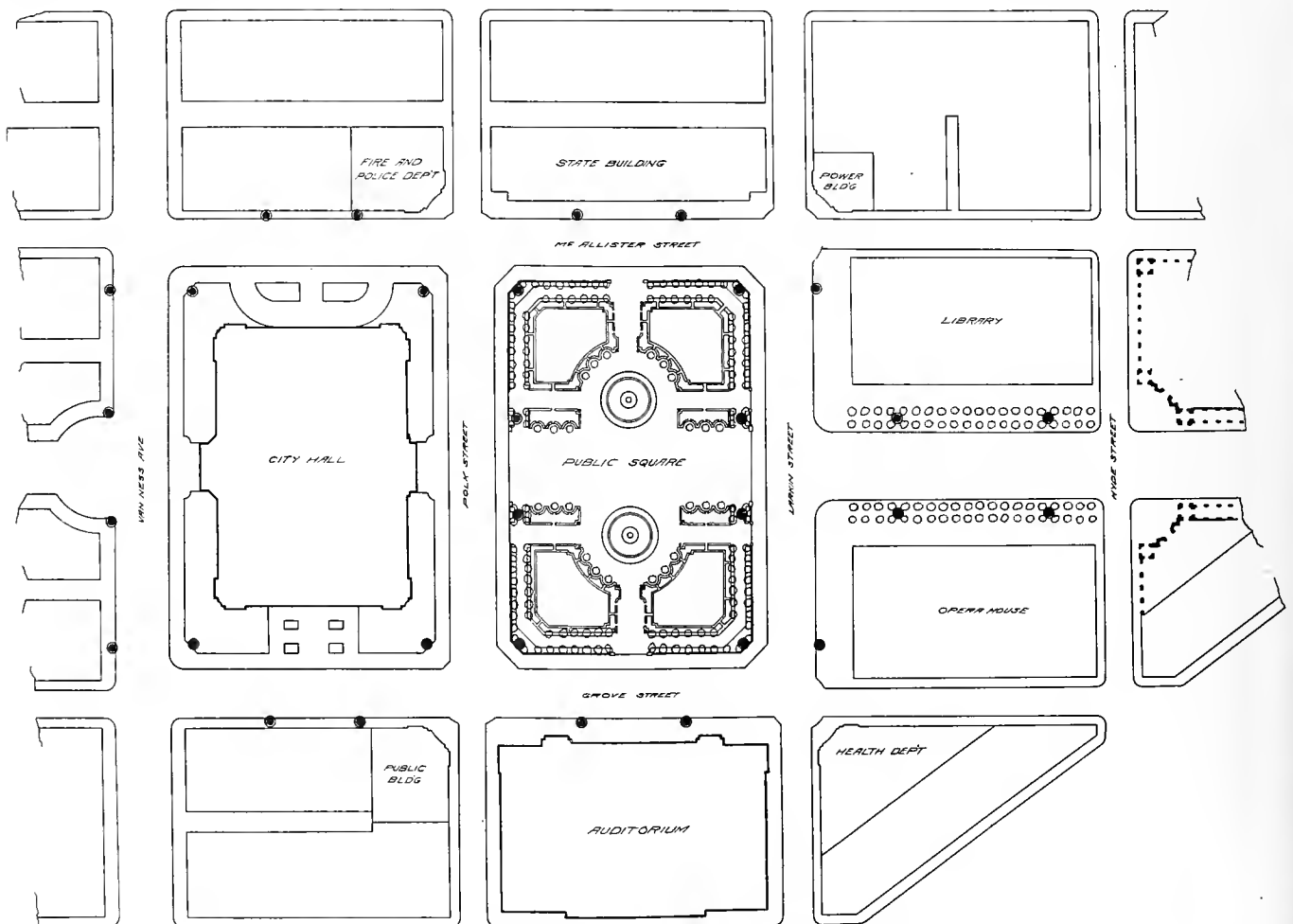
quality. The effect is that of a warm white light, creating life and interest by the slight fluctuations of the arc.

The 137 standards along Market street, including an underground cable system, are being installed by the Pacific Gas & Electric Company at a cost of about \$100,000. The Downtown Association, representing merchants and property owners along the street, have signed a three-year contract for the maintenance of

the two side lights, which are to burn until midnight, and the city will maintain the center lamp on all-night service. The cost for each midnight lamp is \$78.48 per annum, of which \$48.00 is borne by the United Railroads under a former franchise agreement to maintain one lamp on each trolley pole along Market street. The rate for each all-night lamp is \$96.73 per annum.

In addition to this installation the California Board of Harbor Commissioners is erecting six three-light standards in front of the Ferry building, and the Palace Hotel is installing ten three-light standards along New Montgomery street. The latter consist of one ornamental luminous arc lamp and two 200-watt Mazda lamps.

A similar combination of an arc and two incandescent lamps is to be employed in the "triangle" section bounded by Post, Powell and Market streets, which will probably be completed at the time of America's Electrical Week celebration. In this section the standards are 18½ ft. high and carry a 6.6 luminous arc lamp, flashed by two 100-watt Mazda "C" upright bracket lamps enclosed in 14 in. oval gold Carrara globes of less density than the glassware used with the arc lamps. These standards were designed by J. W. Gosling, of the illuminating engineering laboratories of the General Electric Company. The arc lamps are to be maintained by the merchants and property owners at an annual cost of \$110 for each lamp, midnight service. The Mazda lamps will be



© LIGHT LOUIS III STANDARD WITH GENERAL ELECTRIC ORNAMENTAL LUMINOUS ARC LAMPS OR 1500 CP TYPE "C" MAZDA LAMPS

Lighting Plan, Civic Center.

maintained by the city at a cost of \$54.75 per standard per year on all-night service.

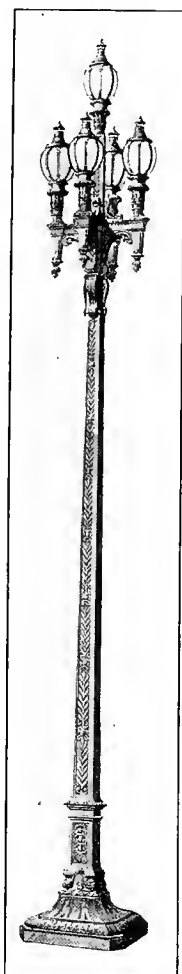
The "triangle" illumination replaces the present method of lighting by means of fin-light Mazda standards, which are staggered at 80 ft. intervals. The same poles and distribution system will be used, together with new underground series arc lamps.

The Pacific Gas & Electric Company has a five-year contract with the Downtown Association for the

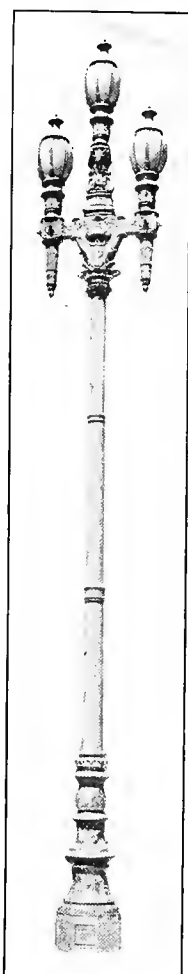
A NEW USE FOR CEMENT POSTS.

Concrete and construction companies in California might profitably apply information that is being gathered abroad relative to new cement uses.

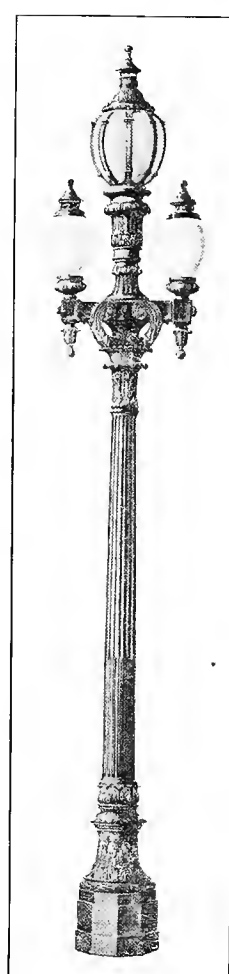
Experiments now being carried on in Germany, if successful, may create a market in the Carlsbad district for an American produce. It is proposed to use cement posts in hop gardens for carrying the wires on which the vines grow. Wooden (pine and fir) poles are



Five Light, 37 ft. Standard, for Civic Center.



Typical Layout for the Three Light Ornamental Luminous Arc Standard.



Luminous and Incandescent Standard.

initial 110 standards in this section. There is every likelihood that the initial system will be extended in the near future.

J. W. Gosling has also designed a five-light standard, 37 ft. in height, for the civic center. Here there are to be thirty standards of Louis XIV design, harmonizing with the exterior building decorations. Six similar standards will be installed at Union Square.

Thus is San Francisco profiting from the lessons of the Exposition, and planning to be the best-lighted city in America, not merely on the criterion of more light, but of better light. Many of her beautiful building facades, flood-lighted, will be really seen for the first time, while the pavements will be lit in accordance with the latest ideas of the art. The new installation marks an epoch in the history of street lighting. Therefore, a celebration is good and timely.

now used. They are about 8 ft. long and cost 80 cents each. They are treated with a preservative to prevent rot, and their average life is 12 to 15 years.

If these experiments are successful, there will be a field here for the placing of cement machines. Its extent is indicated by the fact that in normal times, in the Saaz district, there is a hop acreage of 30,000, and it is calculated that with the present system of wooden poles, 210 poles are needed to the acre. With the use of concrete probably not so many poles would be needed.

The wire now used costs 8.7 cents per pound, a 24 per cent increase over the price before the war. It is estimated that the poles and wires installed in the hop gardens of the Saaz district represent an investment of more than \$3,000,000.

DEPARTMENT CONDUCTED BY S. T. HARDING

[illegible]

The most noticeable feature of these figures is the wide variation for different systems. This is to be expected as the conditions of operation and service rendered vary widely. For this reason mean costs are of little value and are not given.

The operation expenses which are those expenditures directly connected with the delivery of water, average 37 per cent of the total operating expenses for those in evidence before the commission and 34 per cent for the cases based on the annual reports of the companies. Operation expenses are the ones most directly affected by the quantities of water used. If rates are based on the quantities of water used, the relatively high stand-by or demand charge is evident, particularly for conditions where the quantity of water used in different years may vary considerably. The proportion of actual total expense including fixed charges would be much less than the percentages given which do not include fixed charges.

Operation costs per acre depend on many factors. Among these are the extent of the service rendered by the company such as whether delivery is made at the heads of laterals or at the individual farm, the compactness of the area served and the proportion of the area covered which is irrigated, the topography of the country, the quantity of water used, the length of operating season, the conditions of maintenance of canals such as the growth of vegetation in the canal or the deposit of silt, the size of farm unit, the frequency of delivery and size of irrigating head used, and the method of delivery whether continuous or rotative. Without knowing these facts for each company the reasonableness of the costs in any case cannot be judged.

The wide variations in the figures for different companies emphasizes the need of a thorough study in each case before fixing rates and the difficulty of judging conditions on one system by the results on another.

The number of miles of canal operated is also given. The costs per acre can be converted to costs per mile of canal from the figures given. In many cases the costs per mile are a better basis of comparison than the costs per acre.

DECISION OF PUBLIC SERVICE COMMISSION OF WASHINGTON ON IRRIGATION RATES.

Complaint against the successors of the Hanford Irrigation & Power Company has resulted in a decision by the Public Service Commission of Washington which involves the question of the proper basis for rates on systems only partially in use and financially unsuccessful.

The case is that of George E. Benford et al., vs. Consumers' Ditch Company, opinion 1959.

The Hanford Irrigation & Power Company was organized in 1906, the project including the development of power on the Columbia River, pumping and conveying water for irrigation to lands in the ownership of the company. Water rights were sold with these lands. In 1913 the company went into the hands of a receiver and the property was sold at public sale in March, 1915. The purchaser organized three companies to handle the irrigation system, the power and pumping plants and the remaining land, respectively. The capital stock of the Consumers' Ditch

Company was \$10,000. For the canal property and \$5000 in cash, the ditch company gave its capital stock. The rates specified in the original water contracts were \$1.50 to \$2.50 per acre. There was also a provision that these rates should not be changed before 1913 and thereafter the rates should be established by the company. A rate of \$7 per acre was established by the company in 1915.

The sale price was taken as the value of the system. Regarding this the opinion states:

The complete failure of the Hanford Company, the sale price at receiver's sale of its property, and the purchase price of \$5000 in stock paid by the present owners, seems conclusive evidence that the fair value of the irrigation plant was not, and is not, anything near what the property cost the Hanford Company. Particularly is this apparent when consideration is given to the value of the irrigation plant, disassociated from the land and power advantages sold with and as a part of the irrigation project. In any event, the present owners have invested in plant and working capital only \$10,000 in capital stock. We are of the opinion that the sale price in this transaction may be taken as the fair value without any disregard of the property rights of the present owners. The original cost, cost of reproduction, etc., may be used as a guide in making proper allowances for depreciation, and in this regard will have consideration in the rate. In viewing the value of the irrigation plant alone the company can claim no injury by having the commission accept as the fair value the sale price, and we doubt very much if the irrigation plant could be sold on the market today for the price which Mr. Lyons evidently received when he sold it to one of his own corporations.

Of the 6300 acres of irrigable land under the system only 3646 were actually being irrigated, the remainder being in the ownership of the subsidiary land company whose ownership was the same as that of the ditch company. Maintenance and fixed charges were pro-rated to the full 6300 acres, operation cost to the area actually irrigated. The cost of pumping, based on the charges made for pumping by the power company was 50c per acre foot. The lift was not stated. The contracts were for 32 acre inches of water per acre per year. Allowing 40 per cent distribution loss, as found by the commission, the rate for pumping for 32 acre inches per acre was found to be \$2.22 per acre. A rate of 10c per acre inch was found for water in excess of 32 acre inches. For 32 acre inches the rates fixed totalled \$4.66 per acre. Operation, maintenance, taxes, office and general expenses, was \$1.59 and fixed charges, including investment and depreciation, \$0.85. The interest was fixed at 8 per cent on the valuation of \$10,000, or a total of \$800 per year. The depreciation based on physical value totalled \$4532 per year or 45 per cent of the valuation found.

Some of the reasoning used by the commission is given in the following extracts:

The Consumers' Ditch Company owns no water, and has no water that it can sell. To its predecessor, the Hanford Company, may be applied the same statement. It is selling service. The water appropriated is for its own use or the use of the public, and in its relation with the public it is performing a service for which it may be entitled to compensation.

The original investment in this enterprise was undoubtedly made for the joint benefit of the company and for the public. The Hanford Company apparently expected to get returns from the service rendered, and also from the sale of

its irrigable lands at enormous prices, and it should not be assumed now that the rate paying public must carry the burdens of the investment made for the purpose of increasing the sale value of the company's land. It is apparent from the record that the original investment was made on the basis of irrigating so many acres of land, and thereby increasing the value. On this basis the expenses and fixed charges may be pro-rated according to the acreage susceptible of irrigation for which the plant was built. The investment in, and the maintenance of, the plant undoubtedly enhances the value of every acre for which the plant was constructed. It therefore seems unfair for the company to expect those who purchased part of the land to bear the full burden of maintaining the plant, especially in view of the fact that about the only element of value in the land is on account of its susceptibility of irrigation under the irrigating plant.

It seems only reasonable and just that in maintaining the plant and operating the same all the land under the ditch should stand its pro rata of expense. To expect that the few struggling purchasers should maintain the entire plant built as much for the Lyons land as for that of the purchasers is not within the bounds of reason.

The charge for operation, \$2,986.78, is practically the same as that for maintenance, \$2,705.84. If these charges are distributed on the basis of the acres now actually irrigated the charge per acre will be more than it should be, and we will, therefore, make the distribution of "operation charge" to the acres actually irrigated, and the "maintenance charge" will be distributed over the irrigable acres.

SUGGESTIONS FOR BOOKING SOUTH AMERICAN TRADE.

Engineering and construction companies seeking connections in South America will do well to follow the general advice given through the consular offices for exporting cotton goods to that region.

There are three general methods of getting in touch with the cotton goods importers of this district: through traveling salesmen, sent from the United States, through local representatives, and through correspondence. The best way to obtain and then hold the Paraguayan trade in cotton goods would be by a combination of the first two methods—that is, introduction of the goods by a traveling salesman who would appoint a local representative here.

If a traveling salesman is sent to this district there should be a clear understanding between the salesman and his principal as to the extent of the salesman's authority. This is mentioned here in view of the fact that a salesman representing American cotton goods houses recently visited this market and succeeded in booking orders for a considerable amount of goods. In several cases he allowed terms of 30 to 60 days to large and reliable firms. These firms have since received notice from this salesman's principals that they are unwilling to comply with the terms allowed by their representative and request cash in advance. Incidents like this cause very unfavorable criticism of American business methods.

Great care should be exercised in the choice of a local agent, as the selection of the wrong man will be harmful to his principal and to American business in general. Cases have come to the attention of this consulate of agencies offered to persons here where no investigation of their standing or ability had been made.

SKIN EFFECT WITH IRON AND STEEL CABLE.

BY CLEM A. COPELAND.

(This article concludes the series on skin effect. Curves for determining skin effect of stranded steel cables are shown and general conclusions are reached regarding their use.—The Editor.)

Passing to the subject of cables, it appears that the qualities partake very much of the qualities of the individual strands.

This appears from Figs. 8 and 9 although much experimental data is needed in this connection.

Recently some curves for $\frac{1}{4}$ ", $\frac{3}{8}$ " and $\frac{1}{2}$ " cables have been experimentally obtained but unfortunately the methods of testing introduced a severe "proximity effect," the cables being saturated by the return conductor, rendering the results of use only under the identical conditions of the test. Incidentally these curves illustrate one method of reducing K_R to very small values.

It is therefore perhaps superfluous to add that all of the curves in Figs. 13 to 26 in the present paper do not consider the "proximity effect" and may only be safely used where $A_s > 125$ r. When the "proximity effect" is present the phenomena are so complex that an individual experiment must determine K_R and K_L in each case.

Fig. 25 is prepared showing how curves may be constructed for 7-strand cables of various sizes at 60 cycles.

For 50 cycles the similitude to curves for solid wires may be used in the absence of more accurate data.

The maximum values of K_R may be obtained by using the top scale of areas and the straight lines while the maximum points on the (K_R , I_s) curves lie upon the long-dash curves. Four curves for $\frac{3}{8}$ in. 7-strand cables have been constructed as an example.

In a similar manner the construction for curves of larger cables of more strands is shown. In Fig. 26 a curve for a 19-strand "plow-steel" or other high strength steels has been drawn in as an illustration. This figure should be used with caution, as it lacks experimental verification, but is as near correct as the state of the art admits at present. It shows that a resistance at 50 or 60 cycles, and at 250 amperes of $1.65 \times .215 = .355$ ohms per 1000 ft. may be expected when the area is .49375 sq. in.

It is instructive to note that the higher the tensile strength the less difference there is between the 50 and 60 cycle curves so that Fig. 26 may be used probably with equal accuracy for both frequencies.

At the high tensile strengths the specific resistances vary much less with a given change in tensile strength than with softer irons, so that Fig. 26 may be used for all steels above 80,000 lb. per sq. in. in strength.

Having at hand the physical characteristics of iron and steel conductors the question is, when does it pay to use iron and steel. The general impression exists that iron is cheaper than copper, especially at the present time when copper is worth a third of a dollar a pound. The curves show that this depends on the current but in nearly all cases for the same ohmic resist-

ance iron is more expensive than copper and nearly always has been. At the present time a 7-strand iron or steel cable is more expensive than a single copper conductor for the same resistance, while the comparison with single iron and steel wires is not favorable to the permeable materials.

The economic application of iron wires lies in their high tensile strength, allowing the supports to be a greater distance apart. A notable example is the 19-strand, $\frac{7}{8}$ in. plow steel cable spanning the Carquinez

Straits, 4427 ft. between supports, belonging to the Pacific Gas & Electric Company.

For small currents, high voltage lines transmitting small amounts of power, short leads and services, and uses involving tensile strength particularly are economic applications of iron and steel conductors.

It is hoped that future experiments will be made especially on steels having a tensile strength of from 80,000 to 250,000 lb. per sq. in., and on various conductors at low currents and high frequencies stranded

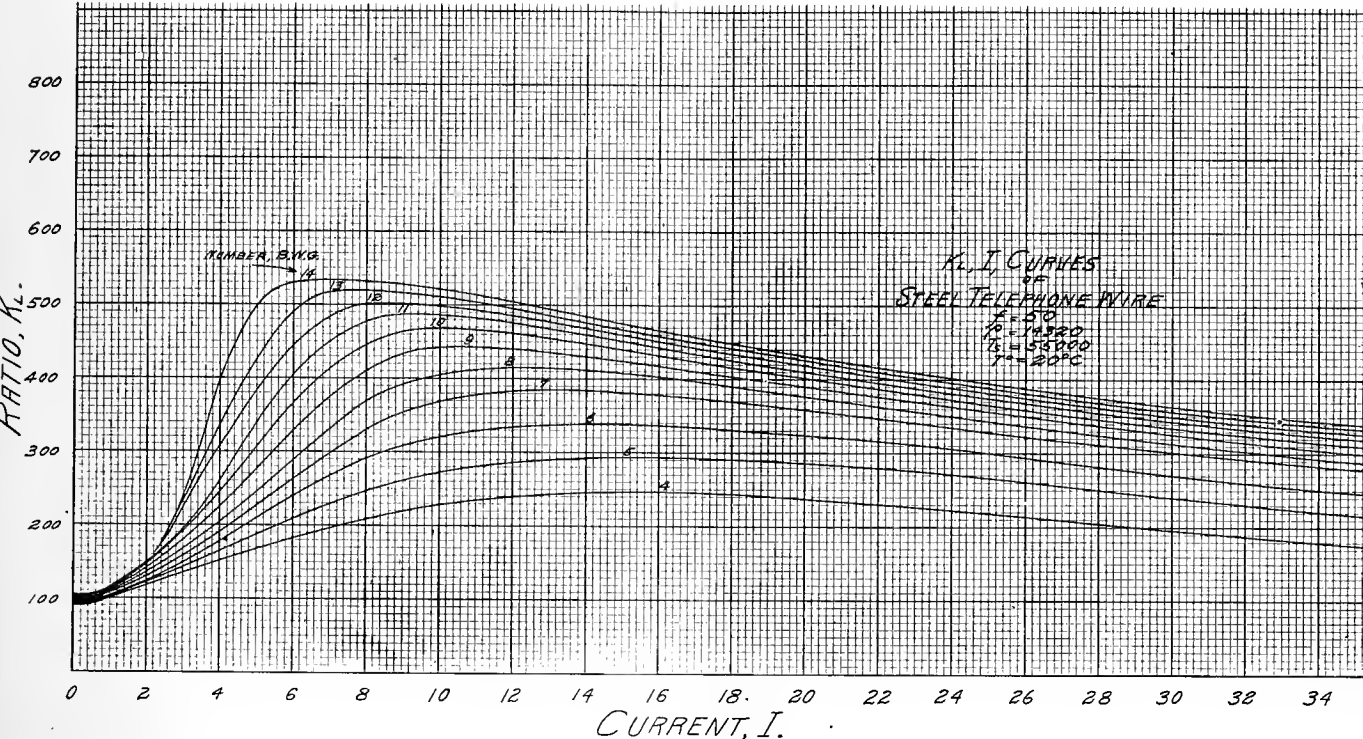


Fig. 21.

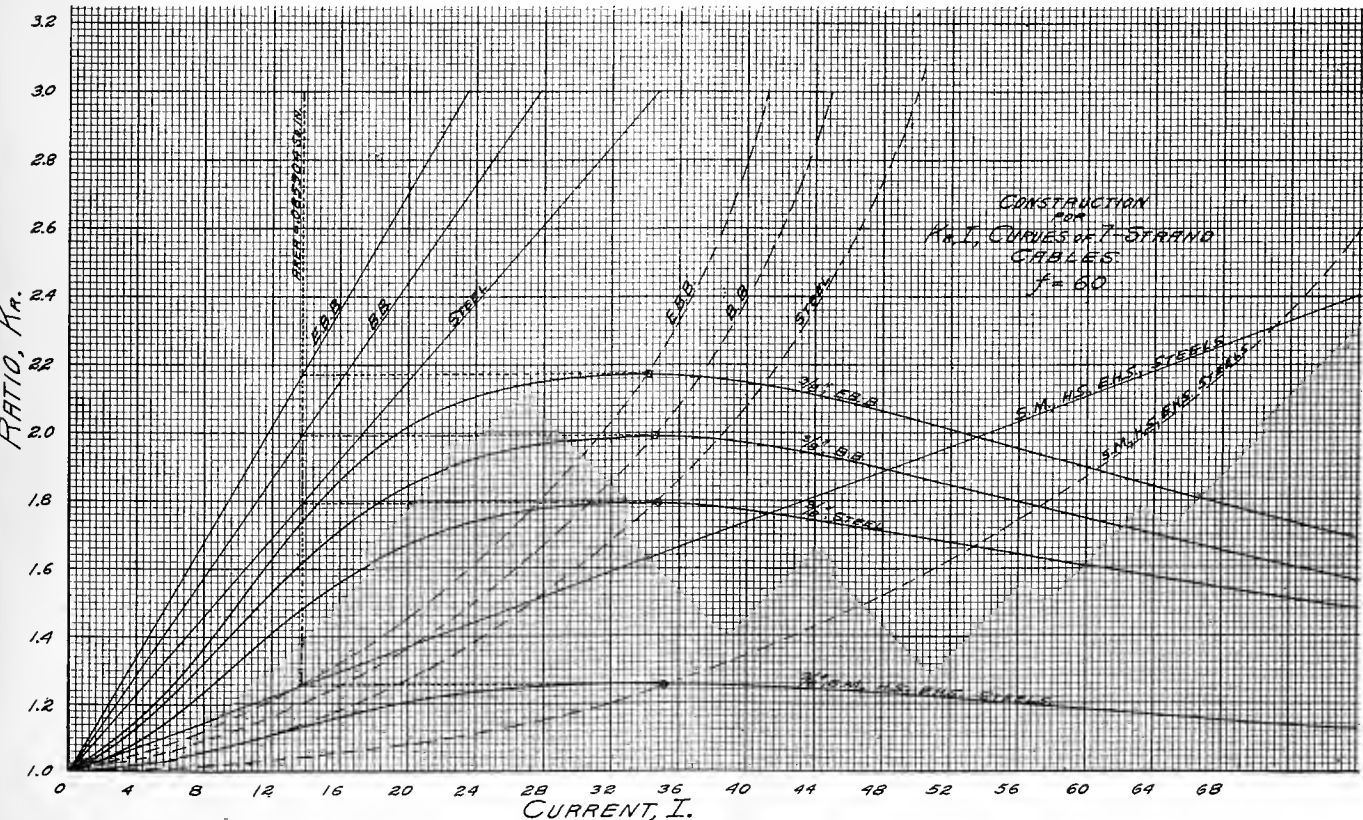


Fig. 25.

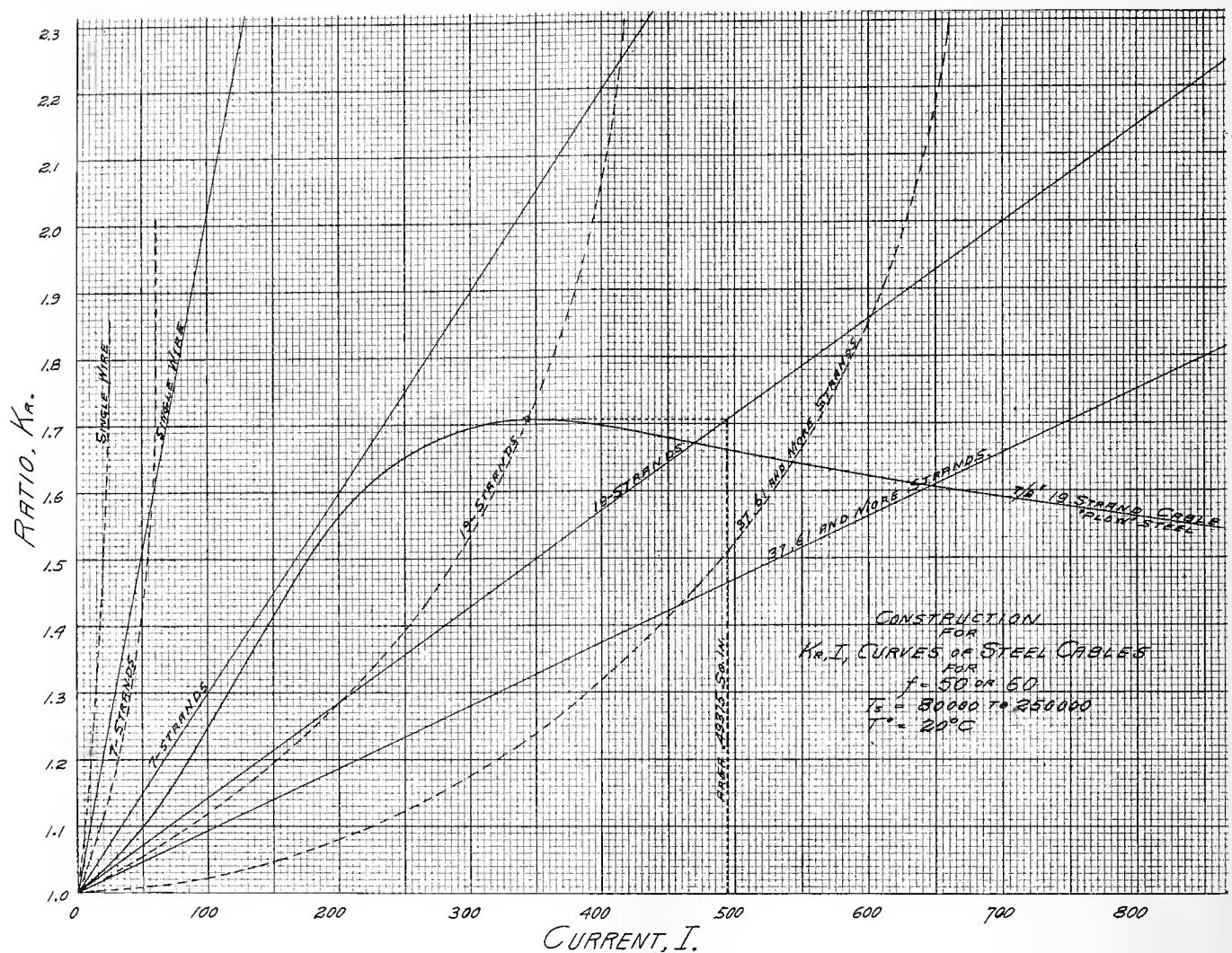


Fig. 26.

cables should be investigated in a thorough manner. The safe carrying capacity of all iron and steel wires and cables are also desired.

PLANS ANNOUNCED FOR WORK UNDER FEDERAL AID ROAD ACT.

Secretary Houston has just announced the plan to be pursued in spending the ten million dollars appropriated by the Federal Aid Road Act for the construction and maintenance of roads and trails within or partly within National Forests, and has tentatively allotted among the various National Forest States the million dollars which is expendable this fiscal year.

The tentative allotments to the principal National Forest States are as follows: Alaska, \$46,280; Arizona, \$59,795; Arkansas, \$11,294; California, \$140,763; Colorado, \$62,335; Idaho, \$108,010; Montana, \$69,901; Nevada, \$19,195; New Mexico, \$42,622; Oregon, \$127,794; South Dakota, \$8,115; Utah, \$40,982; Washington, \$91,739; Wyoming, \$40,566. In addition, a total of \$9552 has been tentatively assigned to Florida, Michigan, Minnesota, Nebraska, North Dakota and Oklahoma, while the Eastern States—Maine, New Hampshire, Virginia, West Virginia, North Carolina, South Carolina, Tennessee and Georgia—in which the government is purchasing lands for National Forests, have been allotted \$21,057.

The method followed in apportioning the money was explained by Secretary Houston as follows: Ten per cent of the amount available each year will be withheld as a contingent fund. One-half of the remainder will be allotted to the States in amounts which will be based on the area of National Forest lands in each State. The other half will be apportioned on a basis of estimated value of timber and forage resources which the Forests contain. Amounts apportioned but unexpended within three years, and any balance of the contingent fund which remains unapportioned at the end of each year, will be reapportioned on the same basis as the original allotments.

POWER SURVEY ORDERED.

Development of hydroelectric power on the Columbia, Snake and Clearwater rivers is made possible with governmental aid through provisions of the rivers and harbors bill, signed recently by President Wilson. Under section 2 of the act the Secretary of War is directed to provide for a survey of the Columbia River from the mouth of the Snake River to Priest Rapids; Columbia River from Celilo Falls to the mouth of Snake River; the Snake River to Pittsburg Landing, Idaho, with a view to the construction of locks and dams for navigation; Clearwater River from its mouth to Orofino.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

The census of 1910 shows a total of forty-five thousand draftsmen and designers in the United States.

* * *

Mica has physical properties which render it of value or indispensable in several industries, such as the manufacture of electrical machinery and apparatus, the glazing and decorative trade.

* * *

Here is something to ponder over. Japan has a Red Cross membership of one million eight hundred thousand, while here in America our enrollment totals scarcely one hundred thousand.

* * *

In 1915 mining companies in the northwest paid in dividends over ten million and a half dollars. This year at the present monthly rate dividend paying will exceed thirteen and a third millions.

* * *

American capital is trending southward. A recent loan of five million dollars has been made to the city of Bogota, United States of Columbia, by the American International Corporation of New York City.

* * *

Ninety per cent of the registration and license fees paid in the United States in 1915 by automobilists to the different states or \$16,213,387, was spent for the building and maintenance of county and state roads.

* * *

To illustrate America's rapid growth in trade with the Orient, take the instance of shipments in rice from Hong Kong for the first three months over several years, in 1912, \$359,180; 1913, \$578,699; 1914, \$490,853; 1915, \$548,799; 1916, \$1,080,555.

* * *

Americans frequently fail to appreciate the size of Australia and its number of people. This great continent has an area of nearly three million square miles and a population of over five million people, almost wholly of British origin.

* * *

The electrical industry on the Pacific Coast is not only fast becoming a coherent enthusiastic unit in itself, but now the household furnishing stores interested in the sale of electric appliances are being drawn into harmonious activity with the electrical contractor dealers.

* * *

A San Francisco boy recently won the national contest for the America's week electrical display over hundreds of competitors. And now a San Francisco boy has secured patents on an improved X-ray apparatus which bids fair to introduce new and extended uses of this valuable apparatus. Next?

—For sometime past inventors and others interested in lowering costs of housewiring have devoted much time to the subject. The concentric cable proposed for wiring already-built houses has proved a disappointment and many of the local electrical organizations are passing resolutions against its use.

* * *

The National Wholesale Grocers' Association advocates that its company members hereafter print on the labels of the canned and boxed goods not only the weight in English units but also the metric equivalent. It's time all were waking up to the simplicity of the metric system before the newly-opened American world commercial opportunities force us to do so.

* * *

Due to the high price of copper wire it is proposed that soft steel conductors be used for housewiring wherever possible. Such a wire would have about seven times the resistance of a copper wire of the same cross-section, and in small sizes the magnetic permeability would be of no consequence in alternating current circuits of commercial frequencies, so far as reactance and skin effect are concerned.

* * *

There will be housed on the electrically propelled superdreadnaught Tennessee, now under construction, over thirty-seven thousand electrical horsepower. Sufficient power in fact to supply the inhabitants of a modern city of about 100,000. If Hercules had had the task of cleaning the stables for such an outlay of horses as represented in this power, the greatest of all of his famous labors would still be unchronicled.

* * *

Consular reports show that the war has affected the world's business in the following manner. Business activities were fairly normal in the various countries of the world during the two years preceding the outbreak of the war. The period of business depression following the outbreak of the war lasted from four to six months. By April, 1916, however, the United States had entered upon a period of business activity unparalleled in the history of the country.

* * *

When our supply of German porcelain was cut off with the outbreak of war in Europe our chemical industries, and especially our chemical laboratories, were hard hit. Today, however, American pottery manufacturers are producing in their own works through their own skill and ingenuity porcelain the equal of any produced in Germany. This is one of the achievements of American chemistry which will be demonstrated during Chemical Week at the Chemical Exposition in New York, September 25 to 30.

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One of the most commendable features of modern public utility operation is the maintenance of an effective, courteous service department. Indeed upon the efficiency of this department often rests the final opinion for good or for bad held in the public mind concerning the usefulness of a public utility company.

The Service Department

So effective has the service department of the utility company been recognized that now the manufacturer and the jobber are beginning to establish service departments. While much expenditure of time and money is necessary to carry on an up-to-date service department still there is nothing that pays greater dividends.

The purchaser of an electric appliance for instance often finds some little kink that he himself cannot unravel and a timely word of advice will do wonders in making him boost for the apparatus when speaking to his friends. Such missionary zeal as this with which the purchaser becomes imbued speaks unconsciously a forceful sales campaign that brings in new business as nothing else will.

The great poet Milton, when blind in middle age, found comfort in his enforced idleness by writing the immortal lines "they also serve who only stand and wait." This waiting attitude on the part of a wide-awake service department, ever ready for action when occasion demands, but quiet, courteous and unobtrusive when not needed, brings big returns for the utility company, jobber, or electrical contractor dealer. There is nothing in human nature that appeals deeper to the emotions nor moves to action quicker than a realization of a kindly interest that is being shown in one's success or accomplishments on the part of others, especially from those of whom it is least expected.

Hence the strong conclusion is to be drawn that success in modern business affairs is largely attained through the courteous, attentive efforts of the service department.

In the present active campaign that is being made to equip the modern American home throughout as an electrical palace, inventors are alert in all quarters in an effort to displace by electrical means the present methods of heating water for household purposes.

The Perfect Electric Water Heater

Although scientists have spent over a hundred years since the days of Joule in establishing beyond cavil the fact that heat is one form of energy whose units bear a fixed ratio with other units of energy, still even in this enlightened day inventors claim to be perfecting electrical devices for heating water in such amounts as would represent more energy imparted to the water than is supplied in the electric circuit that energizes the electric heater.

There is perhaps no other ratio more thoroughly and accurately established in modern science than the fact that a British thermal unit of heat energy is equivalent to 777.5 ft. lb. of mechanical energy and that one horsepower hour is equivalent to .746 kilowatt hours.

Using these unit ratios, it at once follows that a kilowatt hour of electrical energy is equivalent to 3412 British thermal units of heat energy. Assuming that

one gallon of water weighs 8.33 lb., we find at once that 3412 British thermal units will raise 4.09 gallons of water 100 degrees in temperature. In other words were an inventor to perfect an electrical water heating device with no wastes or losses at all, the best he could hope to accomplish would be to raise say four gallons of water to one hundred degrees increase in temperature for every kilowatt hour of electrical energy applied.

On a three-cent rate it is at once seen that even the perfect electric device could not heat water at a better figure than 0.750 cents per gallon heated one hundred degrees.

On the other hand let us see what the modern perfect gas heater could accomplish. A cubic foot of gas contains about six hundred British thermal units. Hence every thousand cubic feet contains 600,000 heat units. With gas at eighty-five cents per thousand this means that the perfect gas heater could raise a gallon of water one hundred degrees in temperature for a cost of 0.118 cents. Thus it is seen that the gas rate of 85 cents as opposed to the electric rate of 3 cents will heat six and one-half times the water for the same outlay in money, assuming that the heaters operate under the same efficiency factors.

It is not true, however, that gas heaters can be made to operate as efficiently as an electric heater. It is a well-known fact that gas water heaters as a rule seldom exceed fifty per cent efficiencies as compared with electric heaters which commonly run from eighty-five to ninety per cent. Indeed it is generally conceded that the modern gas range operates at as low as twenty-five per cent efficiency.

It is these low efficiencies which it seems impossible to better that make possible the early triumph of cooking and heating by wire.

Western hydroelectric companies are recognizing this disparagement in figures and as a consequence rates under a half-cent per kilowatt hour are being granted for electric heaters operating on the storage systems. Such rates where practicable to grant are doing wonders in winning over new electrical loads that will be enduring and at the same time loads that present ideal conditions for hydroelectric plants.

Those interested in the development of huge water powers in the West for the manufacture of nitrogenous

The Twenty-Million Dollar Nitrate Plant

products will continue to follow with keen interest the discussion that is going the rounds in governmental circles as to the best place to locate the proposed twenty million dollar nitrate plant provided for recently by Congress.

The President has turned over the consideration of the matter to the Secretary of War, who has asked the Academy of Science to aid in determining which method of electrical fixation of nitrogen from air is the most practicable for the purpose of this plant that is to manufacture munitions in times of war and nitrogenous fertilizers in times of peace.

In investigations undertaken thus far two sites have been prominently mentioned—the power development at Keokuk, Iowa, and the proposed power development on the Priest Rapids of the Columbia. The former is at once eliminated due to its ability to dispose of its power at a figure beyond that at which fixa-

tion of atmospheric nitrogen is commercially feasible. The latter—a promising prospect—has been eliminated due to a ruling of the War Department which sets forth that the site must be chosen somewhere between the Rocky and the Allegheny Mountains and under no conditions to be within 200 miles of a seaboard or border. This ruling affects not only the Priest Rapids proposed development but, indeed every other Western water power possibility. In other words this ruling eliminates over two-thirds of the possible hydroelectric developments in the United States.

Undoubtedly the ruling is a wise one, however, and one that all loyal and patriotic citizens should support, for in times of war the munitions plant should be well within the interior and protected as far as possible by all natural barriers of distance and configuration of country that may be reasonably brought to bear.

Seeing that the West is thus eliminated, a splendid opportunity is thereby given for all western observers to view the procedure of this undertaking from an absolutely unbiased and truly patriotic viewpoint.

The one feature that will perhaps result from this plant's being located east of the Rockies will be the early appearance of privately owned nitrogenous hydroelectric plants on the Pacific slope.

The government thus taking the lead in hydroelectric development for fixation of atmospheric nitrogen will unquestionably thereby create a confidence that has hitherto been lacking in enterprises of this sort in the Americas although European countries have for some years past reaped an enormous harvest from artificial nitrogenous products. Indeed it might be safely said that the foresight of Germany in fostering this industry has been the life-saving element of her present colossal defense.

The ultimate application of the gigantic powers of the West in the development of electrochemical industries has long been the dream of all well-wishers for the harnessing of these great natural resources.

It would seem that the building of this great twenty million dollar nitrate plant, while barred from Western location, will as a matter of fact do more toward immediate encouragement of this development in the West than any other single advance in recent years.

During the past several months engineers all over the United States have been engaged in gathering a voluntary patriotic inventory of the industrial activity of the nation for the use of the United States Naval Consulting Board. When the time does arrive for the development of Western waterpowers for electrochemical industries the preparedness of the nation will be vastly advanced. It is none too early for some preliminary action to be taken by the government in encouraging these activities with this very end in view. Such encouragement would mean much in getting these industries started and when in operation a certain sense of security is bound to be felt throughout the nation and yet as a move for a peace-loving nation no better activity could be initiated than one which seeks to put the natural resources of a country to grinding out fertilizers to replenish the soils and new electrochemical industries to build up the industrial strength of our Western Empire.

PERSONALS

J. M. Chamberlain, of the Fobes Supply Company, has returned to Portland from a brief trip to California.

H. F. Holland, Pacific Coast representative Simplex Electric Manufacturing Company, is at Seattle from Los Angeles.

F. H. Poss, western representative of the Benjamin Electric Company, has been at Los Angeles during the past week.

John F. Alden, president of the Locke Insulator Company of Victor, New York, was at Salt Lake during the past week.

Harry S. Whitney, president of the Pierson, Roeding Company, has just returned from a business trip to Salt Lake City.

H. B. Carter, formerly of the Pacific States Electric Company, has just returned from a sojourn at Newport Beach.

C. G. A. Baker, vice-president and secretary-treasurer of Baker-Joslyn Company, has returned to San Francisco from Los Angeles.

F. H. Leggett, manager of the San Francisco office of the Western Electric Company, left August 29th for a five or six weeks' trip in the East.

F. D. Weber, Portland correspondent of the Journal of Electricity, Power and Gas, has left his offices in Portland for a two weeks' vacation.

A. V. Guillore, representing the Pacific Light & Power Company, Los Angeles, is in temporary charge of the Mt. Whitney Power Company at Visalia.

Richard A. Cooke, president of the Hawaiian Electric Company, Ltd., Honolulu, and wife, are on a visit to San Francisco. They are at the Clift Hotel.

G. Sherman, stores manager of the San Francisco office of the Western Electric Company, has just returned from Los Angeles where he has been for the past week.

H. T. Carlton, of the Rieber Laboratories, San Francisco, will go East September 13th to attend the American Roentgen Ray Society convention at Chicago in the interests of his company.

Dwight B. Deane, manager of the Pullman Car plant at Cleveland, of the J. G. Grille Company of Philadelphia, was in San Francisco during the past week and left for the East Monday.

Carl Young, general manager Illinois Electric Company, has returned from a three weeks' business trip through the East, visiting the main office at Chicago and attending the lamp conference at Cleveland.

W. S. Berry, sales manager of the San Francisco office of the Western Electric Company, leaves September 10th for Portland and Seattle. He will also attend the Jobbers' meeting at Hayden Lake, Idaho, September 21-22-23.

Miles F. Steele of the Benjamin Electric Company of San Francisco, left Chicago this week for the Northwest. He will attend the conventions at Seattle and Jobbers' convention at Hayden Lake before returning to San Francisco.

F. S. Mills, supervising engineer for the National X-ray Reflector Company of Chicago, Ill., has recently moved into new quarters at No. 234 Bankers' Investment Building, San Francisco, with Los Angeles offices at No. 1132 Citizens Bank building.

A. H. Halloran, vice-president and managing editor Journal of Electricity, Power and Gas, is at Seattle, where he has been attending the conventions of the American Institute of Electrical Engineers and the North West Electric Light and Power Association.

Frank Killam, of the sales department of the Pacific States Electric Company, has just returned from his vacation. He tells quite a thrilling story of following a bear all night. How far up the tree either he or the bear were is not

stated, but his being here to tell the story is proof positive that the bear didn't kill him.

G. A. Schneider, Western Electric power apparatus specialist, leaves on September 11th for the Western Electric Power Apparatus Conference to be held at Chicago, Ill. During his trip he will also visit the factories at Ft. Wayne, Schenectady, Boston and Lynn, Mass., in addition to visiting the Western Electric factory at Hawthorne, Ill.

Frank Rieber, chief engineer of the Rieber Laboratories, San Francisco, is contemplating a trip to Chicago and New York the latter part of the month. During his visit east Mr. Rieber will exhibit at the meeting of the American Roentgen Ray Society in Chicago his new 120,000 volt direct current X-ray generator, a recent invention of his laboratories.

W. S. Heger, Jr., formerly with the Busch-Sulzer Diesel Engine Company, has just returned to San Francisco from Milwaukee where he motored with his wife and family in a Buick car, making the trip east in nineteen days and returning in eighteen days. He was presented with a silver cup from the Buick company. Mr. Heger returned with several agencies in the electrical line and will establish headquarters in San Francisco.

E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.; **F. H. Gale**, General Electric Company, Schenectady, N. Y.; **W. J. Crambs**, Puget Sound Traction, Light & Power Company, Seattle, Wash.; **A. A. Gray**, Electrical Review and Western Electrician, Chicago, Ill.; **C. H. Hodkinson**, Edison Electric Illuminating Co., of Boston, Boston, Mass.; **Ray D. Lillibridge**, 111 Broadway, New York City; **J. C. McQuiston**, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.; **A. H. Manwaring**, Philadelphia Electric Company, Philadelphia, Pa.; **S. M. Kennedy**, Southern California Edison Company, Los Angeles, Cal.; **H. N. Sibbald**, National Quality Lamp Division of G. E. Co., Cleveland, Ohio; **Edward B. Strong**, Journal of Electricity, Power and Gas, San Francisco, Cal.; **Alan Sullivan**, Toronto, Ontario, Canadian Electrical Association, 910 Excelsior Life Building, and **Geo. W. Elliott**, Orienta Point, Mamaroneck, N. Y., as chairman, have all been appointed by H. A. Wagner, president of the National Electric Light Association, to serve on the transportation committee during the coming year.

OBITUARY.

Samuel H. Weidenthal, manufacturer of electrical appliances at 623 Mission street, went into the basement of his home, 183 Jordan avenue, August 31, to lock the windows. He was found later, dead upon the floor. Heart disease was the cause.

NOTES ON UNIVERSITY EXTENSION IN CALIFORNIA.

The purpose of University Extension is to assist those who are unable to undertake a formal course of study in a school, college or university, but who desire to begin or continue their studies in a definite and systematic manner. In the University of California the work is organized as a division carried on through seven bureaus, namely, a Bureau of Class Instruction, a Bureau of Correspondence Instruction, a Bureau of Lectures, a Bureau of Public Discussion, a Bureau of Information, a Bureau of Municipal Reference, and a Bureau of Visual Instruction.

The Bureau of Class Instruction organizes and conducts classes when a sufficient number of persons are willing to join in the study of some single subject, and provides instruction for such classes. Its work approaches in method, and so far as possible, in character, the class work of the university itself. The instruction provided is not limited, however, to university courses.

There is no requirement for admission to a class, save the ability to pursue the work with profit. The fee for a course of fifteen lessons is \$5.00. This must be paid at the

time of enrollment. No fee will be refunded except in case of the discontinuance of a class. All persons who desire to join extension classes should register either in person or by mail at either the San Francisco or the Berkeley office of the Extension Division.

Plan of Organization.

1. The Bureau of Class Instruction organizes and conducts classes in cities and towns wherever a sufficient number of people can be secured who wish to study the same subject. Instruction is offered in languages, literature, public speaking, mathematics, political science, business branches, economics, technology and other subjects.

2. The Bureau of Correspondence Instruction offers instruction by mail in the languages, in literature, mathematics, music, drawing, education, political science, geography and business subjects. Courses may begin at any time.

3. The Bureau of Lectures provides lectures singly or in series of six or twelve for any committee, club, organization, or community in the state that will make the necessary arrangements.

4. The Bureau of Public Discussion promotes and directs interest in the study and discussion of public questions by assisting in the organizing and conducting of "debating clubs" and "discussion centers"; by publishing bulletins of value to beginning public speakers; by co-operating with the libraries of the state in recommending material for study; and by conducting the Interscholastic Public Speaking League of California—a state high school debating organization.

5. The Bureau of Municipal Reference is a clearing house for inquiries and information concerning municipal government and administration. It collects from books, public documents, etc., and from competent authorities in administration, finance, public health and allied subjects, knowledge bearing upon the solution of municipal problems, and distributes it throughout the state. It is allied with the League of California Municipalities.

6. The Bureau of General Information answers inquiries, of whatever nature, addressed to it or referred for answer by the various departments of the university, or by individuals of the faculty.

7. The Bureau of Visual Instruction collects and circulates stereopticon slides, motion picture reels and exhibits. These cover practically every phase of educational work, but chief attention has been given to industrial subjects. They are sent in rotation through the schools of the state and are studied by public schools as a part of the curriculum and by parents and citizens as a feature of community service.

THE STRAWBERRY DROP-FILLED DAM.

The article on the above subject in the issue of this journal, dated September 2d, failed to give credit to the firm of Ford, Bacon & Davis, of New York, New Orleans and San Francisco, who prepared the plans and specifications of this dam and served as consulting engineers. This firm also acted as consulting engineers to the Valier-Montana Land & Water Company for the Birch Creek drop-filled dam containing 216,000 cubic yards of rock in excavation. The Strawberry Dam, and the Birch Creek Dam are thought to be the largest dams of this type in the world.

THE HOOSAC TUNNEL ELECTRIC LOCOMOTIVES.

The Hoosac tunnel of the Boston & Maine Railroad is the largest electrified tunnel in America. The work of digging the tunnel was started in 1831 and completed in time for the first steam train to pass through on February 9, 1875. It is 25,081 ft. long and is double tracked throughout. Until its electrification in 1911 it was always an obstructing feature to the traffic of this railroad. Under steam operation the entire tunnel was a block, only one train at a time being allowed to pass through. Under electric operation several

trains are permitted in the tunnel. The electrification, which is of the Westinghouse single-phase system, has been entirely successful in operation, proven by the ease with which the heavy freight traffic of the road has been handled. Freight trains are no longer packed three or four deep at each portal waiting for a chance to get through.

As many as 77 trains a day pass through the tunnel and regularly 71 trains pass through every 24 hours. Of these about 17 are passenger trains, the remainder freight.

NEW BULLETINS AND CATALOGUES.

The city of Portland, Oregon, has just issued an electrical code containing 180 pages of loose leaf matter relative to electric wiring and installations within its corporate confines.

The Hemingray Glass Company has just issued Catalogue No. 29. This catalogue is practically a reissue of Catalogue No. 28, with reduced outline cuts and of the regulation 8 by 10 size punched for the loose leaf sales book. The catalogue will be supplied free upon request.

The Cutler-Hammer Manufacturing Company has just issued an attractive leaflet setting forth the philosophy of "Petey Dink" with apt reference to the electric gear shift manufactured by that company.

The U. S. Bureau of Mines in its Bulletin 116, just issued, describes in detail methods of sampling delivered coal and gives specifications for the purchase of coal for the government. The purchase of coal by the government under specifications depending on the heating value of the coal, its content of ash and of moisture, and other considerations, rather than upon the reputation or trade name of the coal, was based on the fuel investigations begun by the Technologic Branch of the United States Geological Survey in 1904. The plan was first adopted by the Treasury Department in 1906. Since then the plan, variously modified in form, but the same in principle, has been gradually adopted by other departments until, at present, of the coal used by the government, the total value of which approximates \$8,000,000 annually, more than half is purchased under specifications. The government publications dealing with the adoption by the government of the specification plan, the number of contracts awarded on that basis, and the quality of the coal delivered under such contracts in the several fiscal years covered by the reports are given in publications listed at the end of this bulletin. This bulletin should prove very useful and helpful to those engaged in the purchase of coal for central stations.

TRADE NOTES.

The Electric Construction Company of Oakland, Cal., have been awarded the contract for the electrical work in the new Hall of Records in Oakland.

The McGlaufflin Manufacturing Company, manufacturers of eucalyptus insulation pins, brackets and pole steps, have removed their factory from Sunnyvale to San Rafael, Cal.

The Edison Storage Battery Supply Company announces the opening of their Los Angeles office, fourth floor San Fernando building, Fourth and Main streets. James F. Regan is resident manager.

The Snoqualmie Falls Lumber Company, of the Weyerhaeuser interests, who are building a large saw mill at Snoqualmie Falls has just closed a contract with the Seattle office of Allis-Chalmers Manufacturing Company at Milwaukee, Wis., for what will be the largest steam turbine and condenser ever installed in a saw mill. The unit, which is of the Parsons type, will generate 4000 kilowatts continuously, which is equivalent to 6000 h.p. The power will be supplied by a battery of Sterling water tube boilers. The entire mill will be operated by electric motors and the logging will also be done electrically. Saw mill refuse will be burned under the boilers to generate the steam.



NEWS NOTES



FINANCIAL.

SALEM, ORE.—The net income or profits of the Eastern Oregon Light & Power Company for the year ending June 30, totaled \$21,659.10, according to the annual report filed today with the public service commission. Net operating revenues were \$198,544.78, operating expenses \$84,081.81, and net operating revenues \$114,462.97. The surplus at the beginning of the fiscal year was \$143,480.10, and to this was added \$13,187.87 June 30. The Rogue River public service corporation sustained a net loss of \$16,629.79 during the year ending June 30. The deficit at the beginning of year was \$18,560.76, and at the end, \$35,150.00, operating revenues were \$1,434.37, operating expenses \$5,196.74, and the net operating deficit \$3,716.89.

INCORPORATIONS.

EVERETT, WASH.—Articles have been filed by the Washington Coast Utilities Company for \$100,000. The new concern will supply gas, water and electricity to towns about Arlington.

SANTA ANA, CAL.—Articles of incorporation of the Huntington Beach Telephone Company have been filed with a capital stock of \$50,000. The sum of \$2500 has been subscribed by the five directors who are H. L. Heffner, Huntington Beach; H. Levinson, R. V. Rhodes and C. I. Kline, all of Los Angeles, and James S. Lawshe, of Glendale. The concern is organized for a term of 50 years and plans the erection of a telephone plant with lines which will extend out from Huntington Beach over a radius of 25 miles.

RENO, NEV.—The Honey Lake Valley Mutual Water Users' Association, with D. S. Dickerson, O. Doyle, C. J. Young, W. D. Minckler and Chas. Hollowell as incorporators, has filed articles of incorporation. It is stipulated in the articles that all users of water in the Honey Lake Valley will become owners of the proposed irrigation system after all costs of construction have been paid, and the users of water are given 25 years to pay up their share of the cost of construction. A large acreage of land north of Reno will be furnished with water, and it is expected that a large and rich district will be opened up for cultivation that has been lying idle. Work on the new irrigation will commence at once.

ILLUMINATION.

CHEHALIS, WASH.—The mayor has suggested the advisability of installing standard street lights.

HEMET, CAL.—The city trustees have authorized the installation of a number of additional lights at street intersections.

TWIN FALLS, IDAHO.—The City Council has signed a contract with the Idaho Power Company for installing a street lighting system here.

FRESNO, CAL.—A petition calling upon the board of trustees to sanction the installation of an electrolier system on south J street is being circulated.

EL MONTE, CAL.—The city trustees propose to take up with the electric company the matter of extending its service in the northeastern portion of the city.

PORT TOWNSEND, WASH.—The contract for transformers for the city electric lighting department has been awarded to the Westinghouse Company.

DOUGLAS, ARIZ.—The city council proposes to establish a street lighting district in the downtown section in connection with paving which is now nearing completion.

TACOMA, WASH.—An ordinance has been passed by the council providing for the installation of a street lighting system, consisting of metal standards with single globe lights.

BURBANK, CAL.—The city trustees have passed a resolution, providing for the installation of lights along San Fernando boulevard from Providencia avenue to Cypress avenue.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to September 11, for installing a street lighting system in the Bonita Meadows Lighting District.

REDDING, CAL.—The city trustees received no bids for the construction of the second unit of the municipal street lighting system and it was decided to do the work by day labor.

SANTA BARBARA, CAL.—A resolution of intention has been adopted by the city council which provides for concrete light posts for State street. Plans and specifications have also been adopted.

SPOKANE, WASH.—The Spokane, Heat, Light & Power Company has purchased a lot 100x142 adjoining its present property on Railway avenue, and has made provision for future extensions of its plant.

FLORENCE, ARIZ.—Application has been presented to the city council by the Florence Improvement Company, a subsidiary of the Douglas Investment Company, for a franchise for a water and light system in this city.

FULLERTON, CAL.—The installation of a lighting system in the business district will cost about \$1 per foot, instead of 60c as estimated. Information to this effect has been sent to the property owners who signed the petition asking for the installation of ornamental lighting posts.

LOS ANGELES, CAL.—A petition has been presented to the board of supervisors asking for the ornamental lighting of Figueroa street, between Innla avenue and Delphi avenue; 121st street between Hoover and the east city limits; 124th street between Hoover and the city limits; Laconia boulevard, between the east city limits and the west city limits.

LOS ANGELES, CAL.—The installation of a lighting system is now being contemplated at Beverly Hills. All the improved part of the town, the Sunset boulevard, from the eastern city limits to Camden Way, will be lighted under the proposed improvement, which provides for 436 single standard lights. Underground conduits will be used and the system will be up-to-date in every respect.

OAKLAND, CAL.—News of importance to Oakland business and financial circles was made recently through the announcement that the Great Western Power & Light Company, one of the largest concerns of its kind in the state, had leased the entire ground floor of the Thompson building, at Seventeenth and Broadway, for a term of ten years. According to Manager F. H. Woodward, the power company intends to be installed in its new downtown offices by October 1. Extensive plans for remodeling are now under way. A \$10,000 electric sign will be constructed on the roof of the Thompson building, and from preliminary reports will be the largest of its kind in the West. A striking design is planned in electric light globes. According to Woodward, the company's business in Oakland alone has justified the enlargement of offices. Most of the power being sold is to large corporations and manufactories. The increase in consumers for the past year over 1915 was 24 per cent, while the net earnings increased 21 per cent.

TELEPHONE AND TELEGRAPH.

RENO, NEV.—The telephone company plans to build an additional circuit between Sacramento and Reno at a cost of \$21,230.

ST. JOHNS, ARIZ.—Considerable money is being expended by the owners of the Navajo-Apache telephone system in improvements.

ELMA, WASH.—The Elma-Matlock Telephone Company has been incorporated for \$5000, and will install a farmer's telephone system about Elma.

COLVILLE, WASH.—The board of county commissioners has set September 11th as the date for hearing the petition of Emil Thoni for a telephone franchise over the county highways.

SAN LEANDRO, CAL.—Telephone wires in the business section of San Leandro along East Fourteenth street from the bridge to Maud avenue are to be placed underground within three years.

HEMET, CAL.—Officials of the Southern Sierras Power Company state that the company is conducting experiments looking to the establishment of wireless stations throughout the territory in which it operates.

ESCONDIDO, CAL.—The city trustees have granted permission to the Schumackal Rural Telephone Company, with H. O. Schumackal as president and H. L. Adrian as secretary, to erect a telephone line along Ash street.

SAN FRANCISCO, CAL.—Thirty thousand seven hundred and twenty dollars covers the Pacific Telephone & Telegraph Company's expenses of the San Francisco-San Mateo portion of the project to provide the necessary traffic facilities over its San Francisco-Paso Robles-Fresno route. It is expected that this work will be finished in about 220 days.

TRANSPORTATION.

SAN FRANCISCO, CAL.—At the request of 1000 residents of the Southern Mission District, the supervisors will consider the possibility of constructing a branch of the Municipal Railway along Army street from Church to Third, thence over a street yet to be laid to Hunter's Point.

MARYSVILLE, CAL.—The officials of the Northern electric Railway have taken under advisement a proposal of the city council that arrangements be made with the Southern Pacific for switching privileges over Ninth street. An effort is being made to secure a route for a new spur track to the shops of the Yuba Construction Company.

TRANSMISSION.

CHLORIDE, ARIZ.—Poles have been ordered by the manager of the Desert Power & Water Company for a power line to be run into Chloride. It is thought that the company will be furnishing light here between October 15th and 30th.

UPLAND, CAL.—Work will begin immediately upon the reconstruction of the interior of the Pacific Electric Company's power house, which was almost completely destroyed by fire. It is said the company will modernize the plant in every particular.

LEHI, UTAH.—A deed has been closed for the building of a power plant at the mouth of deep creek in American Fork canyon to supply power for pumps at the head of the Jordan River which elevate water from Utah Lake for the Associated Canal Company's of Salt Lake county. The plant will cost \$175,000. It will have a minimum capacity of 2000 horse power. The plans call for two pipe lines each $1\frac{1}{2}$ miles long.

IRRIGATION.

SALEM, ORE.—Documents authorizing the Morson Land Company to issue bonds in the sum of \$30,000 for the completion of the west unit of its irrigation project have been filed with State Engineer Lewis.

MALTA, MONT.—James O'Connor was the only bidder for handling the excavation work on the Milk River project, amounting to 615,000 cu. yds. The estimate was \$108,352, and the bid was slightly under this.

ST. MARIES, IDAHO.—Property owners in St. Joe, Coeur d'Alene and St. Maries River Valleys held a meeting recently

at Harrison and took steps toward creating a drainage district. Dredging of a portion of the Spokane River will be one of the first steps.

WILLOWS, CAL.—Applications have been filed with the state engineer at Sacramento for the formation under the Wright irrigation act of two irrigation districts, the Princeton-Codora-Glenn irrigation district and the Jacinto irrigation district.

ALTURAS, CAL.—Proposed irrigation projects which would water approximately 250,000 acres will be among other important matters taken up at the annual meeting of the Northern California Counties Association, which convenes in Alturas September 28th.

MYRTLE CREEK, ORE.—At a special bond election here last week the taxpayers voted to bond the town for \$27,000 for improvement of municipal water and light plant. The project involves the installation of a hydroelectric power dam in the South Umpqua River that will develop at minimum 180 horsepower.

SACRAMENTO, CAL.—Plans are being made for the installation of a pumping plant in the Netherland Reclamation District by P. N. Ashley, reclamation engineer. Two pumps with a capacity of 115,000 gallons will comprise the plant, which will be located on the property of the Holland Land Company. The district comprises 25,000 acres.

SOUTH BEND, WASH.—Eli Rockey of Bay Center and others who have combined with him to form a diking district near the mouth of the Palix River, have in contemplation an engineering project which will reclaim 1750 acres of fertile land. The project contemplates the construction of a dike 1400 ft. long and for a flume dam across the Palix River.

LIVE OAK, CAL.—Residents of the Live Oak section believing that the presence of water within 32 in. of the surface is due to water from the irrigating canal, are contemplating taking over the canal with the idea of drying it up and introducing a pumping system. By this means they can use the water that is in the ground for irrigation without bringing in water from the river.

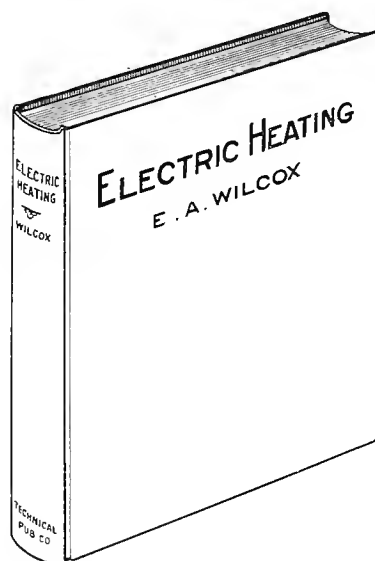
MODESTO, CAL.—Citizens of the newly organized Waterford irrigation district this week voted bonds to the amount of \$465,000 and will at once begin construction of canals that water may be available for the use of the district next spring. The Waterford district will take its water from the Tuolumne River, using the main canal of the Modesto as a right of way from La Grange to the district.

SILVERTON, ORE.—At an election recently to vote on the question of issuing bonds for \$21,000 to provide funds for a municipal auxiliary water system, the bonds were authorized by a vote of 141 to 41. This issue automatically cancels a previous issue of \$16,000. The change in amount was due to a decision to extend the system farther up the Abiqua. The Silver Falls Timber Company has the contract for the work.

ST. IGNATIUS, MONT.—Bids will be received by the U. S. Reclamation Service at this place until September 20th for the construction of canals and structures on the Flathead project, involving 125,000 cu. yds of excavation, 495 cu. yds. concrete, 1000 yds. paving, 10,000 sq. ft. canal lining, manufacturing and laying 3400 ft. concrete pipe, 210 cu. yds. dry rubble wall, and placing 70,000 lb. of structural and reinforced steel. Work is located from 3 to 10 miles of Ronan, Mont.

ONTARIO, ORE.—For the purpose of putting water on 25,000 acres of rich Malheur county land in the vicinity of Nyssa, the Owyhee Irrigation District was formed. Plans for the project were forwarded to John R. Lewis, state engineer, for his examination. It is proposed to build a big dam 70 ft. high at Duncan Ferry; 15,000 of the 25,000 acres comes under gravity system, and the remainder under a pumping plant. It is planned to build a power plant at the diversion dam, and develop enough power to lift water for 10,000 acres of land.

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15

Fuses, Plug.		List.	Sell.
125 Volts.			
30 Amp., each		.07	.05
Fuses, Cartridges.			
250 Volts.			
0-30 Amp., each		.25	.20
31-60 Amp., each		.35	.35
61-100 Amp., each		.90	.80
101-200 Amp., each		2.00	1.80
201-400 Amp., each		3.60	3.20
401-600 Amp., each		5.50	4.90
0-30 Amp., copper neutral		.20	.20
31-60 Amp., copper neutral		.35	.35
61-100 Amp., copper neutral		.60	.60
101-200 Amp., copper neutral		.80	.80
201-400 Amp., copper neutral		1.00	1.00
401-600 Amp., copper neutral		1.50	1.50
Fuses Cartridge.			
600 Volts.			
0-30 Amp., each		.40	.40
35-60 Amp., each		.60	.60
65-100 Amp., each		1.50	1.50
110-200 Amp., each		2.50	2.50
Hack Saw Blades.			
8-inch		.70	.70
10-inch		.85	.85
12-inch		1.00	1.00
Perforated Strap Iron.			
10-foot lengths		.40	.40
Insulators—Each.			
Strain glass or porcelain, 3/8-inch		.0688	.10
Strain glass or porcelain, 1/2-inch		.1180	.15
Strain glass or porcelain, 5/8-inch		.15	.20
Strain Globe, 2-inch		.05	.10
Strain Globe, 2 1/2-inch		.06	.15
Glass W. U.		.088	.10
Glass No. 9 Pony.		.048	.05
Glass, Regular No. 3.		.06	.10
Insulating Joints—Each.			
1/4 x 1/4 to 3/8 x 3/8		.40	.40
1/2 x 1/2 to 1 1/2 x 1/2		.60	.60
3/4 x 3/4 to 1 1/2 x 3/4		1.75	1.75
Hickeys to 1/2-inch		.10	.10
Hickeys to 3/4-inch		.17 1/2	.17 1/2
Knobs—Porcelain—Each.			
3 1/2 Knob, each		.05	.05
4 1/2 Knob, each		.02	.02
5 1/2 Knob, solid, each		.01 1/2	.01 1/2
5 1/2 Knob, split, round, each		.02	.02

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEXNumber
16

Lamp Guards.		List.	Sell.
Lamp guard wire		.29	.35
Expanding, Tinned		.28	.25
Cage, Tinned		.25	.25
Lamp Guard Lock		.44	.50
Lamp Guard Bulldog—complete		2.50	2.00
Lamp Guard Half Reflector		.44	.70
Lamp Guard, ordinary portable, with socket		1.30	2.00
Leatherheads—Nails.			
Per lb.		.25	.25
Lugs.			
Capacity.			
of Wire Hole.			
Amp. Hole.			
30 3/16	2	.04	.04
60 3/4	4	.08	.10
100 3/4	0	.15	.15
200 9/16	0000	.35	.35
400 7/8	525,000 C.M.	.80	.80
600 1 3/32	900,000	1.20	1.20
Miscellaneous.			
Asphaltum Paint, gal.		1.90	1.90
Beeswax, per pound		.64	.64
Emery Cloth, per ream (400 sheets)		26.50	26.50
Fibre, 1-64, 1-32, per lb.		.30	.30
Ins. Staples, per 1000		2.60	3.00
Lacing Twine		3.00	3.00
Lacquer, Black, quart		2.15	2.15
Lacquer, Thinner, quart		1.50	1.50
Mileneite Nails, No. 18, per 1000		1.20	2.00
Nails, 6p, 8p, 10p, 20p, per lb.		.05	.05
Oil, Lard, per gal.		.25	.25
Oil, Linseed, pint		.25	.25
Oil, Machine, per gallon		.60	.60
Oil, Motor, gal.		.87	.87
Oil, Plumbers Cutting, per gal.		1.00	1.00
P. & B. Paint, quart		1.26	1.26
Paraffine, per pound		.30	.30
Pipe caps, 1/2		.11	.11
Pipe caps, 3/4		.18	.18
Pothead Compound, per gal.		4.50	4.50
Red Lead, per pound		.25	.25
Sandpaper, per ream (480 sheets)		4.25	4.25
Shellac, per gal.		3.20	3.20
Soapstone, per pound		.10	.10
Wood plugs, 1/2		.01	.01
Wood plugs, 3/4		.02	.02
Wood plugs, 1		.03	.03

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ALPHABETICAL INDEX TO ADVERTISERS

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| B-1 Baker-Joslyn Company..... 2
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ELECTRIFICATION OF THE OREGON PORTLAND CEMENT COMPANY.

BY D. C. FINDLAY.

CONCRETE PIPE IRRIGATION SYSTEMS.

BY S. T. HARDING

NOTES ON THE PACIFIC COAST CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRI- CAL ENGINEERS.

NOTES ON THE CONVENTION OF THE NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION.

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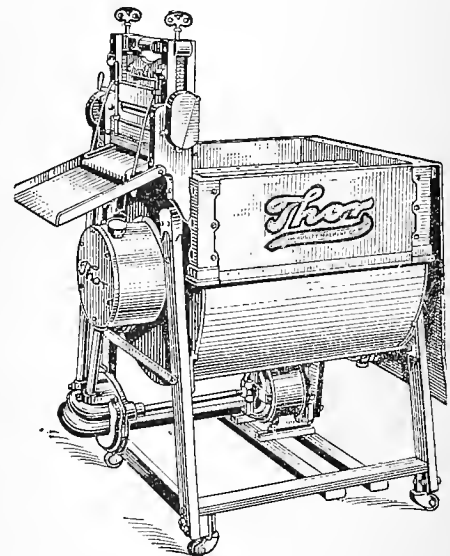
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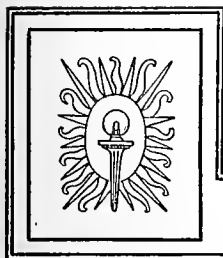
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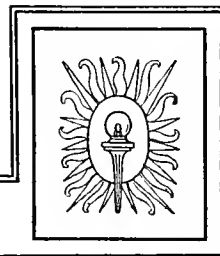
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VOLUME XXXVII

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ELECTRIFICATION OF A MODERN CEMENT COMPANY

BY D. C. FINDLAY.

On June 1, 1916, the Oregon Portland Cement Company made the first barrel of cement ever manufactured in Oregon. The mill is located at Oswego, about eight miles south of Portland on the Southern Pacific railway and on the bank of the Willamette River, thus affording alternative transportation of the finished product.

All the most modern features of cement manufacture have been adopted and every effort made to pro-

duce a dustless plant with very gratifying results. The entire construction is of reinforced concrete with every roof built of concrete, practically eliminating depreciation and fire hazard. The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., supplied the entire electrical equipment which was installed by the cement company.

The power is received at 57,000 volts, 3-phase, 60-cycle, from the Portland Railway, Light & Power Company's transmission line, through a 3-pole air break 60,000 volt pole type switch mounted on a 2-pole structure 8 ft. from the rear of the substation wall

as shown in Fig. 2. The power enters the station through aluminum, outdoor type choke coils, and Locke High Voltage roof insulators on to a high tension bus suspended by disc insulators from the concrete roof slab as shown in Fig. 7.

This bus, and all the 57,000 volt wiring consists of $\frac{1}{2}$ -in. galvanized conduit, instead of copper tubing, greatly reducing the cost of insulation. All joints in the conduit were cleaned with gasoline, and the

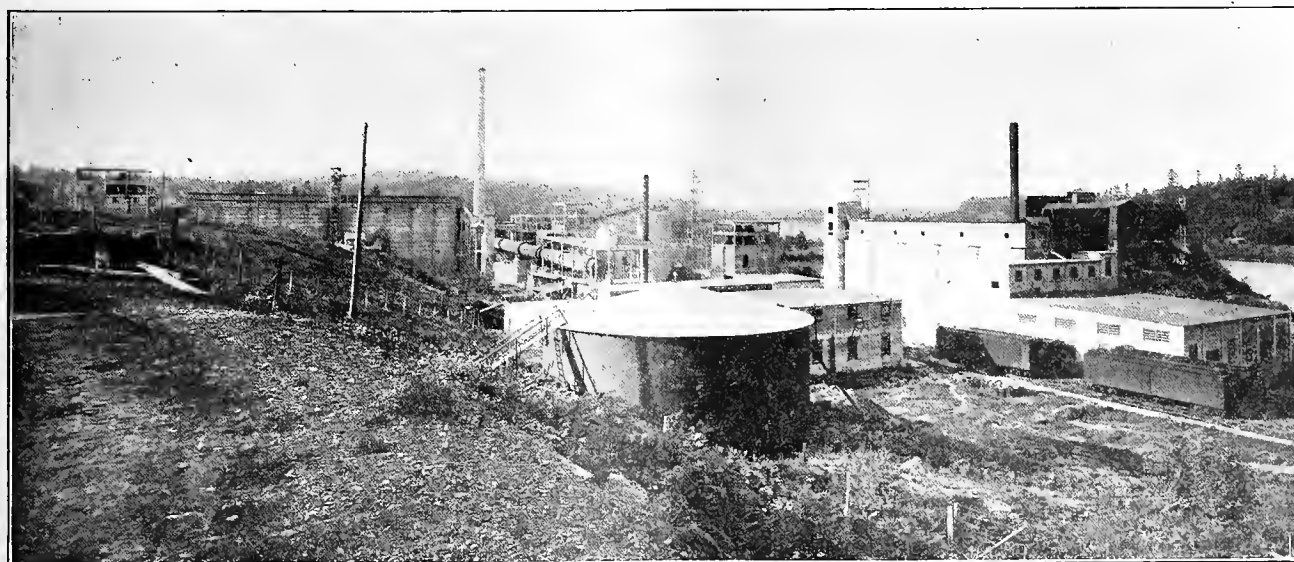


Fig. 1. General View of Oregon Portland Cement Company.

couplings sweated to the pipe, insuring as good conductivity as the pipe, which has sufficient carrying capacity for the high tension current.

Taps are taken off this bus, to three single pole knife switches, leading to the high tension series relays, type H.B. which are mounted vertically on insulators. Micarta insulating links, 66 inches long, operate the low voltage relays mounted horizontally on a piece of 6 in. channel, and having adjusting screws to regulate the exact length of the links for tripping. These relays have inverse time limits operated by bellows, which prevent them short circuiting the magnet coil

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which keeps the 60,000 volt Type G. A. oil circuit breaker closed, unless the overload is maintained long enough to allow the relay to move its entire travel.

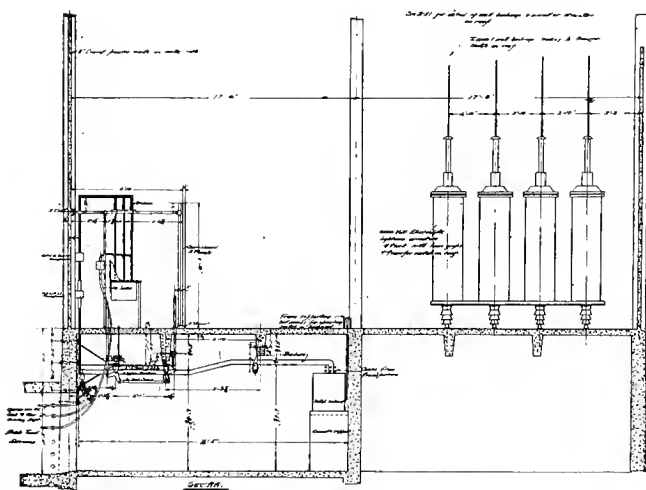


Fig. 2. Substation Equipment and Location.

The magnet coil on the oil circuit breaker also has a snap switch on the back of the board in its circuit, enabling the operator to trip the switch from the board.

Fig. 3 shows wiring diagram of the station. Disconnecting switches mounted on the back of the same structural steel framework over the circuit breaker, which supports the relays, connects to a transfer bus suspended from the roof, from which taps are taken to both 3-phase transformers. Fig. 4 is a photograph of these transformers.

These transformers are 1000 k.v.a., 57,000 volt to 480 volt, 3-phase, water cooled with 4 high tension taps, and are "Y" connected with grounded neutral. Only one transformer is used at a time, the other being held as an emergency spare, and disconnected from the line on both sides.

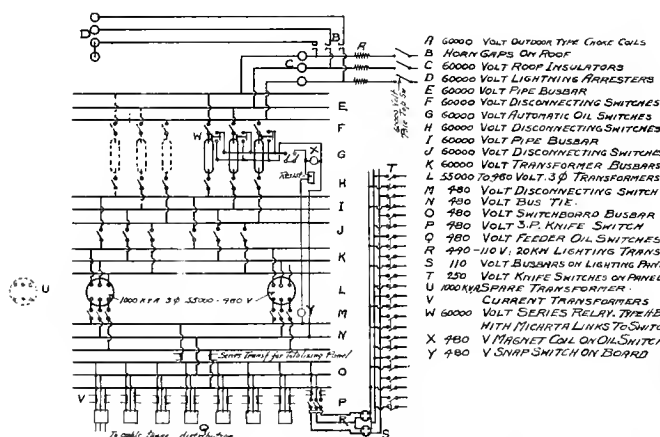


Fig. 3. Wiring Diagram for Cement Plant.

The 440-volt cables leaving the transformers, drop through fibre bushings into the basements, and pass through a novel type of disconnecting switch, consisting of two 3-pole, 1500 ampere unfused, knife switches, with quick break clips, mounted face to face in the ends of a steel cabinet which is supported on a concrete slab, on piers about 5 ft. from the floor.

The bottom of the switches are tied together with heavy copper straps, and from the middle of this, the busbar copper rises vertically through slate protected openings in the top, and passing horizontally under the floor beams, passes through the floor, and directly to the switchboard distribution busbars.

A rigid arm is fastened to the top of each 3-pole switch, which acting through bell cranks and a lever, passes up through the floor to a bell crank on the operating floor, and is opened and closed by the use of a removable handle, after a pin is removed from a hole in the leg of the bell crank, which serves as a positive lock against accidental disconnection.

The cable type current transformers are mounted on the vertical rise of the busbar on an iron frame which supports both the power company's and the cement company's transformers. The secondary leads are taken in conduit through the floor, and directly to the bottom of the totalling panel on the switchboard. Potential transformers for operating the control circuit of the curve drawing wattmeters are mounted under the floor slab in the basement directly below the switchboard.



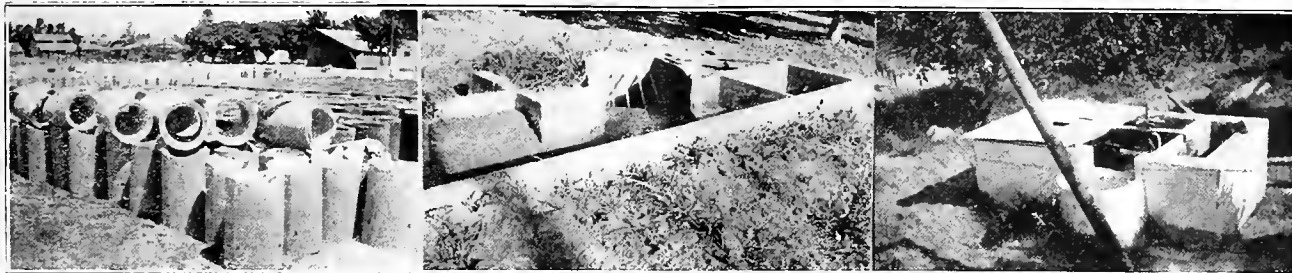
Fig. 4. Transformer Equipment.

On account of inability to procure solid busbar copper in Portland, or vicinity, the expedient was adopted of taping together twenty No. 1 solid bare copper wires into a busbar, and connecting them at all angles, with red brass castings having the wires securely soldered in. This has been very satisfactory.

(To be continued.)

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING



Concrete Pipe Yard, Inlet to Pipes and Division Box for Irrigation.

CONCRETE PIPE IRRIGATION SYSTEMS.

The conveyance of water secured from pumping plants in concrete pipe is a usual practice in California and to some extent in other states. It is also used on some irrigation systems where water is delivered in relatively small irrigation heads particularly on sloping or irregular land. Water delivered to individual farms in ditches may also be carried to the fields in concrete pipe.

Concrete pipe distribution systems are now used for the large majority of citrus groves in California. Pipe has largely replaced the concrete flumes formerly in use, present construction being nearly all of pipe. It is also used for walnuts and deciduous fruits in those sections where water has a high cost. In some portions of the state concrete pipes are used for the irrigation of alfalfa, where small irrigation heads, such as those secured from pumping plants, may be carried to the fields in concrete pipe and distributed by movable light galvanized iron surface pipe. The concrete pipe used for all these purposes is similar although the stands and other auxiliaries naturally vary with the method used and with crop that is to be irrigated.

A pipe system of field distribution has many advantages over either ditches or flumes. Being below the depth of cultivation, the full area of the field is available for team work. With ditches and flumes special team or hand work is required to prevent the growth of weeds along the ditch. Pipes are more permanent and less liable to injury from farm machinery. The water is more closely under control in a pipe system than in any other method. Small depressions can be crossed without fills or trestles and water can be carried down steep slopes without erosion. The spouts or distributing gates to the furrows are also less liable to become stopped with leaves than in flumes.

Of the different kinds of pipe which may be used, concrete has the advantage of being made from materials which can be secured locally, thus reducing transportation charges, and of requiring a relatively inexpensive equipment for its manufacture. In practically all sections where concrete pipe is in use, contractors can be found who are experienced and equipped to both manufacture the pipe and construct the system complete. The methods of making such pipe have become fairly well standardized and little difficulty is now experienced in getting pipe of satisfactory quality for usual conditions.

For the sizes of pipe used on individual farms, 6 to 12 inches in diameter, the concrete used can perhaps more properly be called a mortar. This is necessary as the walls are only from 1 to 1½ in. thick. A mixture of four parts sand to one part cement is usual for ordinary pipe. In some cases a mixture of 1 to 3 is used where higher pressures are to be carried or where it is desired to counterbalance the effect of poor sand. The latter practice, however, is not desirable, since only clean, well graded sand should be used.

The pipe is made by the "dry mix" process. This is done in order to reduce the number of molds required. The concrete is hand tamped into the molds which are removed as soon as the length of pipe is complete. As a pipe crew may make from 100 to 250 lengths per day, depending upon the size and method of working, the quick removal of the mold materially reduces the cost. The pipes are left standing on a base or bottom ring for about 24 hours. The pipe is then turned and the base ring removed. It is usual to give the inside of the pipe a brush coating of neat cement to increase its freedom from leakage. In some cases lime may be used with the cement in this coating. It is necessary to keep the pipe damp during the period of setting. This is accomplished by sprinkling at in-



Irrigation by Means of Pipe Lines and Furrows.



Sand Box for Concrete Piping, Zigzag and Basin Methods of Irrigation.

tervals for about a week. Proper setting will not take place if the pipe is allowed to dry out before it has become cured.

Denser pipe can be made by using a wetter mix. For pipe which has to withstand considerable pressure and for reinforced pipe such wetter mixtures should be used. For the usual conditions encountered in farm distribution systems the added cost has been considered to be in excess of the benefit.

Concrete pipes are laid sufficiently deep so that the top will be safely below the depth of plowing. Any grading of the land should be done before laying the pipe or the pipe laid to correspond with the final surface. For the smaller sizes, trenches 2 ft. deep will place the pipe below danger of disturbance. Pipes are not used in districts where freezing needs to be considered.

The ends of the pipe are made tapering without any bell. This simplifies both the trenching and laying. The tapered ends are inserted and a collar of mortar placed around the joint. The jointing mortar is usually a 1 to 2 mix. Two foot lengths of pipe are used for all sizes. Longer lengths of the smaller sizes could be handled but the difficulty of cleaning the inside of the joints would offset any advantage due to the reduction in the number of joints. The pressure or head as it is usually called, to which it is safe to subject ordinary concrete pipe, depends on the size of the pipe and its thickness. The usual thicknesses and the maximum pressure heads which should be permitted are shown in Table 1. If surges or conditions

resembling water hammer are to occur, less pressure heads should be used. Such surges should not be permitted. For this reason it may not be desirable to connect the concrete pipe directly to the discharge of a pump. Where feasible a stilling box should be used, into which the pump discharges and from which the water flows into the pipe line. This can be done when the water flows away from the pump by gravity. Where water is forced to higher ground wood or steel pipe should be used if the pressure exceeds the figures given in Table 1.

TABLE I.
Allowable Pressure Heads for Ordinary Small Plain Concrete Pipe.

Diameter of pipe in inches.	Thickness of pipe in inches.	Allowable Pressure Head in feet	
		1:4 mix.	1:3 mix.
6	1 1/8	16	20
8	1 1/4	14	18
10	1 3/8	12	16
12	1 1/2	10	14

The cost of concrete pipe depends on the quantity to be used, the cost of gravel and cement, the length of haul from mixing yard and the experience and character of the labor used. The various factors cause the cost to differ to some extent in different localities. For the amount of pipe used on the average size of individual farm, it is cheaper to have the manufacture and laying of the pipe done by contract. Dependable local pipe yards and contractors can now be found in nearly all localities where much pipe work is being done.

The usual costs of concrete pipe are given in Table II. These are arranged to give maximum and minimum as well as average figures. Under unfavorable

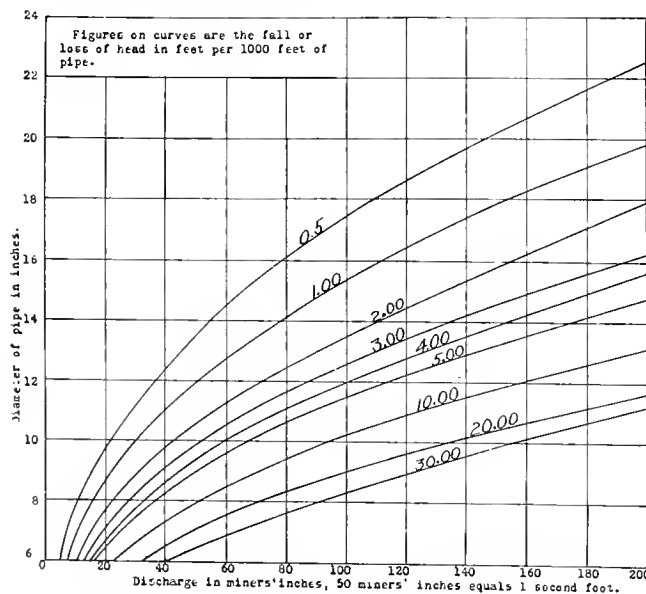


Fig. 1. Carrying Capacity of Concrete Pipe in Cubic Feet per Second.

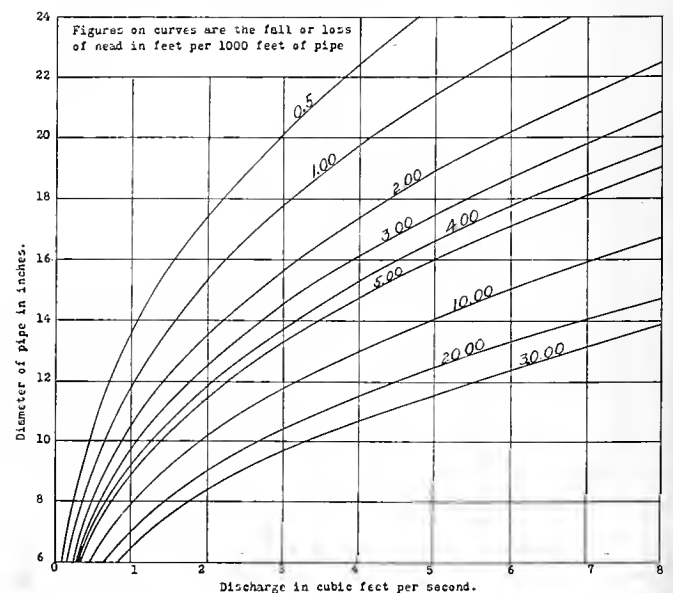


Fig. 2. Carrying Capacity of Concrete Pipe in Miners' Inches.

conditions for material or for small jobs of less than 1000 ft. the maximum figures become a safer basis of estimate. For very favorable conditions the minimum costs can be used. For ordinary conditions the systems should be secured for the average figures.

TABLE II.
Cost of Small Concrete Pipe, 1:4 Mix., in Cents per Lineal Foot.

	Size of Pipe in Inches.			
	8	10	12	14
Cost of pipe, only.				
Usual minimum	9	11	15	20
Usual maximum	15	18	25	40
Average	12	15	20	30
Cost of pipe line—laid, including trenching and back filling.				
Usual minimum	15	18	25	35
Usual maximum	20	25	35	50
Average	18	22	30	42

Pipes of 8 and 10 in. diameters when made of 1:3 mixture cost an average of about 3 cents per foot more than the 1:4 mixture.

The costs given are for the pipe lines only. They do not include the stands, gates and other auxiliaries.

Figs. 1, 2 and 3 give the usual carrying capacities of small concrete pipe in different units of measurement. The unit of measurement in general use in the portions of California where such pipe lines are used is the miners' inch equal to 1-50 of a second foot or 9

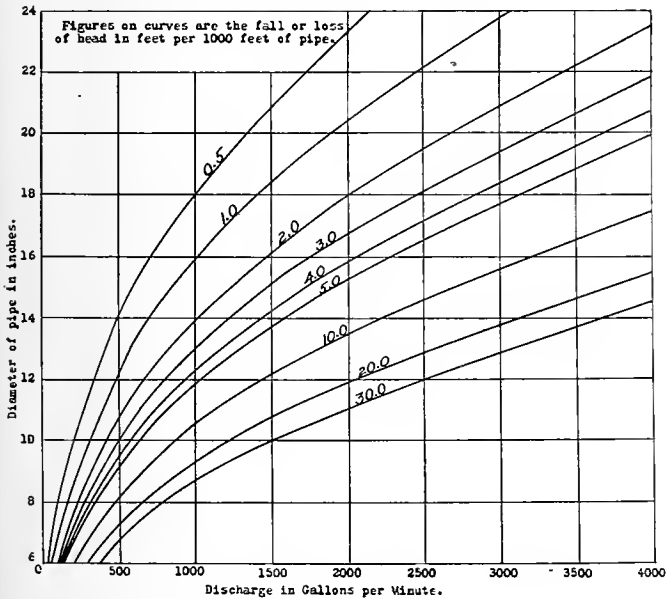


Fig. 3. Carrying Capacity of Concrete Pipe in Gallons per Minute.

gallons per minute. The value of the miners' inch in other states may differ. The statute value in California is 1-40 of a second foot. The curves for carrying capacity are given in three units. All other units can be reduced to cubic feet per second or second feet as it is more commonly called. In connection with pump capacities, the unit of gallons per minute is sometimes used. Four hundred and fifty gallons per minute are equal to one cubic foot per second.

The carrying capacity for a given pipe varies with the square root of the slope. In order to double the velocity and capacity it is necessary to increase the slope by four times.

With open ditches the slope available is in general limited to the natural fall of the ground. With pipe lines under pressure it is possible to secure the equiv-

alent of additional slope by having the water enter the pipe line under some initial pressure. This may be of advantage in reducing the size of pipe required on flat slopes. Also the pressure may be used to force water against the slope of the land.

The carrying capacities given represent average conditions. They are based on a value of "n," the friction factor in Kutter's formula, of 0.0135. For pipes having a cement coating that are carefully laid true to line and grade, the capacity may exceed the figures given. For pipes laid without careful cleaning at the joints and not true to line the capacity may be less than shown. Any deposit of silt or sand reduces the capacity correspondingly. Where sand is present in the water, the use of a sand box such as that shown in the illustration is desirable. This is sometimes the case with water pumped from new wells.

The majority of pipe systems for single farms consist of 8 or 10 in. mains. Where the heads are small 6 in. pipe is generally used. This condition may occur on the lower ends of distributing lines, the size of the pipe being reduced for the last two or three hundred feet. A combination of 10 and 8 in. sizes is more usual than that of 8 and 6 in. For some conditions such as flat grades or large heads pipe larger than 10 in. in diameter may be used although this is not usual.

The irrigation streams or heads handled in pipe lines usually vary from 25 to 60 miners' inches. To carry 25 inches in a 6 in. pipe requires a grade of 10 ft. per 1000 ft. For the same head in 8 in. pipe only 3.5 ft. per 1000 are required. To carry 60 in. in an 8 in. pipe a grade of about 15 ft. in 1000 ft. is required. The same quantity can be carried in 10 in. pipe on a grade of 4 ft. per 1000 ft. A grade of 4 ft. per 1000 ft. is equivalent to a total fall of 2.5 ft. across the end of a 10 acre lot or in 660 ft. This amount of fall is usually available or can be secured by having the water enter the line under some pressure. For this grade 8 in. mains will carry about 35 miners' inches and 10 in. about 60 in. Where over 40 in. is to be handled the use of 10 in. pipe is preferable unless there is more than average fall to the land.

QUICK EMPTYING OF A CANAL.

Shutting water out of a canal too quickly may cause damage from bank caving. This may occur where a break makes it necessary to reduce the discharge as soon as possible. The water contained in the saturated earth on the sides of the canal may cause the banks to slip before then can drain. This is most likely to occur in the heavier soils and on canals where the conditions of construction or operation have resulted in forming steep or vertical banks. Such caving may occur on canals of pumping systems if the pumps are quickly stopped. Such canals are more usually built on flatter grades and with more care than has been the case with many of the older gravity systems. It has also been noticed on canals which may operate normally without erosion, that cutting is liable to occur when operation is renewed if for any reason it is necessary to turn the water out for a period and then restore the full flow quickly.

NOTES OF THE A. I. E. E. CONVENTION AT SEATTLE

The Pacific Coast convention of the American Institute of Electrical Engineers at Seattle was called to order at 11 a. m., September 4th, by Professor C. E. Magnusson, who first introduced Mayor H. C. Gill. Mayor Gill, after telling of Seattle's electrical pre-eminence extended cordial welcome. Fitting response was then given by Professor H. J. Ryan, who briefly reviewed the wonderful works recently accomplished by the members of the organization here represented and also expressed their appreciation of Seattle's hospitality.

President H. W. Buck was then introduced as the presiding officer for the sessions. After emphasizing the value of territorial meetings in nationalizing the Institute, President Buck introduced the several authors who read papers as abstracted hereafter.

President's Address.

President H. W. Buck after paying high tribute to Western daring and initiative in engineering accomplishment, spoke briefly on the Engineer's Standing in Society. Though most great changes in modern progress have been brought about by engineers, this fact has not been appreciated by the public largely due in the opinion of the speaker, to the engineer's prejudice against business matters. Mr. Buck urged that engineers acquire a broader viewpoint and become a more active factor in development work. The A. I. E. E. has already contributed greatly to engineering progress. Of the problems of the immediate future the most pressing is correcting defective insulators, "the curse of the electrical business today," causing most of the troubles experienced from lightning and from surging. After showing this dependence of electrical upon other branches of engineering, he pointed out the value of co-operation. While the war has emphasized the engineer's importance in military matters the fact should not be forgotten that engineering is equally important in times of peace.

A Distribution System for Domestic Power Service From Commercial and Engineering Standpoints. By Carl H. Hoge and Edgar R. Perry.

Edgar R. Perry, a commercial engineer for the Puget Sound Traction, Light & Power Company, has in this paper, together with C. H. Hoge, worked over the problem of distribution for domestic service in order to accommodate the ever-increasing demands for new electric household appliances.

The adoption of electric heating and cooking has begun to reach such large proportions that the average distribution system is unable to take care of the increased load. As the domestic power load in all probability will increase until every house is electrically equipped, this paper has endeavored to lay out a distribution system to take care of this class of business and to estimate the revenue to be derived from it. Units of load, consumption and revenue were taken from tests conducted in different parts of the city and applied to a definite section of the city thought to be representative, as it contained every class of house with schools, churches, etc. In view of the results obtained, it would seem that this business would be profitable at a still lower rate, and that it would be advisable for the central station man to make provision for this increased load when rebuilding any lines in the future.

In conclusion the authors believe that the development of domestic power will necessitate the complete reconstruction

of existing lines. New substations will have to be built for each 10,000 kw. of load and located approximately at the center of the district served. The heavy load in this service will require three-phase distribution, which will also take care of small power loads. They believe that domestic power can be developed into a profitable part of the central station business, and sold at a price that will be attractive to the consumer. The present rate schedules, which necessitate two meters and a flat cut-in for this business, are not satisfactory and a new basis for charge must be developed that will utilize a simple, inexpensive meter and can readily be understood by the layman. With increasing volume of business, the rates can be lowered materially below those quoted herein, and still yield an adequate return. It is up to the central stations to make an intensive campaign for domestic power service, for this is the solution of the problem of profitably serving residence business.

The discussion was participated in by D. F. Henderson, J. B. Fiske, M. T. Crawford, F. D. Weber, C. R. Collins, W. D. Peaslee, E. G. Robinson, S. M. Kennedy, H. W. Buck, W. L. Chrysler, H. J. Gille, R. F. Howes and E. R. Perry. During the discussion it was brought out that the hypothetical distribution was a three-phase system with return neutral, secondaries not being interconnected. The estimated load density is at least twice that at present found in the most thickly populated portion of Seattle and would call for a generating capacity of at least 400,000 kw. to care for residence business as compared with a present demand of 25,000 kw. It was shown that the cooking load will ultimately be the determining factor as regards peak conditions. Advocacy of the one-meter system was confirmed and the suggestion made that a high minimum rate and low energy charge would tend to encourage electric cooking. The average householder spends about \$150 yearly for light, cooking and water heating with present methods, whereas similar electric service could be had for \$200 yearly at Seattle's experimental rates. The public is gradually being educated to the fact that operation of household electric appliances does not require the services of an engineer.

Some Features of Domestic Electric Cooking and Heating. By H. B. Peirce.

The author is assistant commercial agent for the Washington Water Power Company, and is engaged in building up the electric cooking and heating load for his company.

Although electric cooking and heating has always been considered possible, it has only recently become popular; hence the engineer is found unprepared with information on the characteristics of the load.

From tests made on a number of domestic cooking and heating installations, it would appear that electric cooking has a better load factor than a lighting load and that this load factor improves as the number of ranges increases.

The errors incident to these tests are discussed.

The demand factors on being plotted against number of ranges appear to follow a logarithmic curve, which may be accounted for by the fact that a modification of the law of probability would no doubt determine the probable coincident demand of a number of ranges and that this law is a logarithmic function.

Suggestions are made for the checking of these results by others.

In the heating field, the effect of water heaters superimposed on range loads is discussed in relation to their effect on the central station loads and income.

Those participating in the discussion included J. B. Fiskén, C. E. Magnusson, W. D. Peaslee, Ralph W. Pope, C. R. Perry, H. F. Holland, H. J. Gille.

Electrical heating of buildings was shown to be practical in communities where there is not too great a variation in temperature and where off-seasonal uses for the power could be found. A short circuited induction heater having 98 per cent power factor was suggested as less expensive than resistance type heaters requiring frequent replacement of elements, but was shown to be so sensitive to voltage variations as to be impracticable. Under test a 2 per cent change in voltage gave 40 per cent variation in current. Because of limited supply of hot water where an electric heater is alternated with the range, a flat rate was advocated for water heating. Any system whereby electric house heating be considered as an auxiliary to other heating methods would fail because people would not install duplicate systems.

Temperature Rise of Insulated Lead-Covered Cables. By Richard C. Powell.

The author of this paper has had extensive experience with insulated lead-covered cables in Oakland, California, and the San Francisco Bay region, where he is with the Pacific Gas & Electric Company in their underground construction work.

After a brief historical note the factors that determine the rating of a cable are considered.

The thermal conductivity of a cable is expressed in terms of the volume thermal conductivity of the insulation, the surface thermal conductivity of the lead sheath, and the dimensions of the cable. The values of the thermal conductivities as given by various observers, including the author, are compared. A diagram is shown for readily obtaining the thermal conductivities of one-conductor cables, and tables are given of the carrying capacity of one-conductor cables for various duct temperatures and thicknesses of insulation. Factors are added so that the carrying capacity of multiple-conductor cables may be taken from these tables.

Sometimes the lead sheath of a cable carries considerable stray current. A formula is given for calculating the increased temperature due to such current.

The carrying capacity of a cable is largely determined by the thermal properties of the duct line in which it is installed. This feature is discussed briefly.

The overload or intermittent rating is calculated from a formula involving the thermal capacity of the cable multiplied by a factor. Experimental values of this factor for several types of cables are given. A formula is given to take account of variable air temperature.

Various formulas given in the paper are developed in three appendixes.

Discussion was confined chiefly to the effect of parallel or crossing steam mains on electric duct lines. L. T. Merwin cited experience where a flood saturated the ground and the water surrounding both the steam mains and electric duct lines was raised to a temperature of 228 degrees above the usual heating of the lines. However, by means of artificial flooding and cooling there was only one failure in 14,000 ft. of cable. The author's figures were shown to be ultra-conservative as regards safe carrying capacity. H. W. Buck told of experiences at Niagara Falls which

taught that with a.c. single conductor cable should be avoided where possible as the unavoidable current loss in the lead sheath was practically equal to the copper loss. The heating effect was great enough to carbonize the paper insulation. Suggested cooling methods included a parallel pipe filled with running water or a vacant central duct through which air may be forced as needed and also giving a convenient method of determining temperature. Others contributing to the discussion included M. T. Crawford, J. B. Fiskén, S. C. Lindsay and C. R. Collins.

Inductive Interference as a Practical Problem.

A. H. Griswold and R. W. Mastick of the Pacific Telephone & Telegraph Company, after briefly reviewing the factors causing inductive interference in telephone lines from high voltage power transmission circuits, took up from a practical standpoint the methods actually employed to bring about mitigation of voltage arising from balanced lines and to minimize residual currents. Higher harmonics must also be eliminated from the power lines and abnormal operating conditions guarded against. The equilateral triangle construction was shown to cause less trouble than either vertical or flat construction. Transpositions co-ordinated along both power and telephone circuits are the simplest and most effective means for remedying inductive effects caused by balanced voltages and currents, the inductive effect thus being neutralized in the case of the power circuit and equalized with the telephone circuit. On the other hand, the "longitudinal" induction from residual voltages and currents can be cured only by reducing or eliminating the residuals in the power system. One of the most effective means is not to ground the transformer neutrals except at generation and main distribution stations. These typical cases of mitigation methods were worked out in detail for appendix gives detailed direction for making a survey of power and telephone lines preparatory to calculating the mitigation of induction.

The paper was discussed by Frederick Bedell, L. T. Merwin, J. B. Fiskén, W. D. Peaslee, C. A. Robinson, L. J. Corbett, C. A. Whipple and R. W. Mastick. In the course of the discussion it developed that the telephone company had tried out all the possible remedies, such as shunts and series impedances, but had discarded them in favor of those described in the paper. Any scheme for fitting out the higher harmonics seriously cuts down the range of transmission. The objection to flat construction is simply the matter of cost, more frequent transpositions being required. Defective and grounded power insulators cause serious disturbances on the telephone lines, as likewise does the charging of electrolytic lightning arresters. Care in the accurate location of transpositions in the field was shown to be essential to the success of any plan for mitigation. J. B. Fiskén stated that the grounding of transformer neutrals only at generating stations and important substations would help the power operator as well as the telephone man. The most important feature of the entire discussion was the evidence of the growth of the spirit of co-operation and mutual understanding between the power and the telephone companies. The practical methods for correcting inductive interference have not proven so burdensome to the power companies as originally had been feared, and each side seems to be working to help the other.

Testing for Defective Insulators on High Tension Transmission Lines. By B. G. Flaherty.

The author is district operating agent for the Puget Sound Traction, Light & Power Company.

This paper discusses the importance and necessity of field tests on high-tension insulators and three methods of making such tests, viz.: with the oscillator, the megger, and the telephone receiver. The latter is described in detail, and some data given on its development and use on a 60,000-volt line in Western Washington, covering a period of 2.5 years. Laboratory checks on 13 of the defective insulators located are given, and an approximate relation established between the telephone receiver test and the break-down value at 60 cycles. Success of test is shown in note on its effect on operation.

Figures from regular routine tests show percentage defect on various lines, and cost of locating and replacing defective units is given at \$1.13 each (labor only), and cost of testing only was 2.3 cents per insulator on the line.

A method of studying the rate of depreciation is outlined and some data given in illustration.

Professor H. J. Ryan outlined the plan of investigation now under way at Stanford University to devise some means of correcting insulation troubles. A study of porcelain shows that its porosity is the cause of the failures experienced in its use. Porous materials are not permanent, a porous body being one which absorbs up to 3 per cent of its weight of water. For insulators this figure should be limited to 0.1 per cent. Porcelain's high temperature of vitification and high resistivity temperature coefficient, not losing its insulating properties until 450 degrees C. is reached, makes it desirable as an insulator. Furthermore the resistivity of many porcelain insulators taken from the lines is not changed by "drying out," though with some the resistivity is thus increased. If insulators are dried out for several hours at 125 degrees C. they absorb moisture very slowly. Uniformity in product is the great inherent difficulty in the manufacture of porcelain. Vitrified quartz arrow heads, the product of a lost art, would make an ideal material for the purpose. Fused quartz withstands corona discharges while porcelain does not, it is everlasting.

L. T. Merkin had found wireless dispatcher's set to be a practical means for detecting defective insulators while driving along a transmission line at 15 miles an hour.

E. A. Loew emphasized the need for a practical method of testing porcelain insulators on the lines if their use is to be continued. Such a method should be cheap, reliable and should eliminate the personal equation.

John B. Taylor in contributed discussion stated that the proposed method required extreme caution on the part of the operator and was only adapted to wooden poles.

Others taking part in the discussion were M. T. Crawford, W. D. Peaslee, Ralph, W. Pope, Chas. Osborne, Mr. Harding and C. E. Magnusson. Mr. Osborne detailed break-down tests and lightning experiences where porcelain insulators did not fail.

The High-Voltage Potentiometer. By Harris J. Ryan.

Professor Ryan, of Stanford University, has long been known as an investigator of high voltage and high frequency phenomena. In this paper the author describes a high voltage potentiometer which may be made at reasonable expense, consisting of a water resistance potential distributor and a

sparkling probe potential difference detector. The water resistance consists of a column of water moving slowly through an ample length of garden hose, and tapping in points through which to connect the probe are provided by breaking the hose at regular intervals and connecting it with any of the plain metal connectors found on the market as "hose menders." The result of an integrity trial are charted in the figure. The device is intended for investigations in which the results are not required to be known within 2 or 3 per cent of their actual value.

Frederick Bedell and W. D. Peaslee paid tribute to the value of this paper.

An Artificial Transmission Line With Adjustable Line Constants. By C. Edward Magnusson and S. R. Burbank.

Professor Magnusson, a life member of the Institute, and a joint author of this paper, has conducted numerous experiments upon artificial transmission lines in his electrical laboratories at the University of Washington.

A description is given of an artificial transmission line which can be readily adjusted to represent 200 miles (321.86 km.) of commercial transmission lines of any spacing up to a maximum of 120 in. (3 m.) and any size wire up to 4/0 copper. It can also be made to correspond to aerial or cable telephone lines and to power cables. The use of this type of line in laboratory courses on transmission line phenomena is illustrated by a number of typical experiments. It is shown that quantitative data, sufficiently accurate for instructional purposes, may be obtained by using portable voltmeters and ammeters and by the oscillograph.

That artificial transmission lines can be used to advantage in investigations on transmission line phenomena is well known. It has been proved by extended research that actual transmission line phenomena can be accurately reproduced in laboratory structures, and that the theoretical equations correctly express the quantitative relations between the line constants, voltages, currents, time and space phase angles and other factors that enter in the general transmission line problem. Artificial transmission lines have, however, been used only to a very limited extent either as laboratory apparatus for experimental work by students in power transmission courses, or by engineers when investigating industrial transmission systems. Very few engineering colleges have any facilities for laboratory work on transmission lines. The instruction is given by lectures, text-book recitations and class-room problems, without the aid of quantitative laboratory experiments. As a consequence comparatively few students gain a clear insight into transmission line phenomena, and although they may be able to develop the standard equations, they fail to comprehend the physical phenomena involved or to understand what actually takes place in the transmission system.

Participants in the discussion included H. J. Ryan, L. J. Corbett, W. D. Peaslee, J. D. Ross, C. A. Whipple and C. E. Magnusson. Difficulties to be overcome in such work was discussed and suggestion made that central stations might well have such a laboratory to try out experiments. The value to the teacher, student and layman was emphasized.

Electrical Operation and Merchandizing in Small Towns.

This paper by Lewis A. McArthur and C. R. Young of the Pacific Power & Light Company, and W. F. Farquhar of the Washington Water Power Company, gave details of operating accounting and new business methods of small branch offices. In the former case 16 local managers, clothed with considerable authority, report directly to the vice-president and general manager, who has charge of all operating and new business affairs, and are accountable to the accounting department. Meter reading, collections, payrolls, small ex-

penditures, and the consumer's ledgers are handled locally. Bills are addressed at a central office. Stationary forms are standardized. Audits are frequent. Competitive prizes are awarded for best show windows, reduction in outstanding delinquents and smallest store accounts. Small community merchandizing is done by local managers, supplemented by concentrated competitive sales campaigns. Standard lines of electrical appliances are carried in stock and demonstrated.

Mr. Farquhar summarized reasons why central stations do merchandizing and wiring, and explained their plan of organization whereby each town is a nut under the supervision of the general agent. Small towns are covered by local merchants who are sold supplies at 10 per cent above cost for resale at a profit and are paid a small salary as fix-light men. These are supplemented by a sign salesman and a range specialist, as well as extensive advertising in one morning paper given general distribution throughout the territory. The merchandise account shows a profit of \$2 for every account on the line. The stock of wiring materials and fixtures was turned over three times during 1915. An aggressive wiring campaign is being carried on by a force of fifteen specially trained college men.

Overhead Line Construction Rules.

This paper by M. T. Crawford of the Puget Sound Traction, Light & Power Company, presented arguments demonstrating the unreasonableness of Washington rules specifying line construction details. They are especially objectionable because of retroactive features and lack of definite certainty as to meaning after companies have already complied with expensive city ordinances and because they are likely to be superseded in turn by the National Safety Code. The rules increase the cost of new construction from 10 to 25 per cent in the case of city and 10 to 15 per cent in case of rural lines. This, together with additional advance in cost of materials and severe reduction in revenues, have allowed an average of but 20 per cent of existing lines to be reconstructed in accordance with the rules. Unless relief is provided companies will be sorely tried to meet complete conformity by 1918. Furthermore, the National Safety Code is not locally acceptable because it is not believed that it will be applied with intelligence and proper consideration of local conditions. It is remedially suggested that rules be used only in an advisory manner and not given enforced application to widely varying conditions and that the laws be confined to the definite fixation of liability for accidents due to line equipment and the requirement of financial responsibility before construction and operation is permitted. The Oregon and Idaho rules are believed to be reasonable. Brief specifications are given for lines conforming to the Washington rules.

Characteristics of Admittance Type of Wave Form Standard. By Frederick Bedell.

Professor Bedell has long been recognized as an earnest student of electric wave phenomena and has added much to our mathematical and practical knowledge of the subject.

It is generally agreed that a sine wave of electromotive force at generator terminals and on transmission lines is best. A sine wave is now specified as standard by the Standardization Rules of the Institute, but the present methods for prescribing allowable limits and for determining how near an actual wave is to a true sine wave are very unsatisfactory. The Standards Committee, through a sub-committee, is studying the subject in order to ascertain whether a standard can be specified that will be more suitable in its characteristics and more practical in its application. As a contribution to this study, the characteristics of a certain type of standard are here set forth.

It is hoped that various points of view and much information may be brought out in discussion, which may be on the general subject and not limited to the particular phase discussed in the paper.

After describing the two types of standard possible—namely, the simple and the composite—the author then discusses the proposed admittance types and leaves for discussion certain questions of specification that must be decided upon if this type is to be adopted. Some of these points are as follows:

1. Shall the standard circuit be a simple circuit, as described in this paper, or a composite circuit?
2. If a simple circuit is to be adopted, shall this circuit contain an inductance and, if so, how much; or, in other words, what shall be the resonant frequency?
3. How much resistance shall the standard contain? Should this resistance be different for circuits of different frequencies, or should it be the same for all frequencies?
4. What numerical value of the factor thus specified should be allowed in acceptance of alternators?
5. What details and what load conditions conducting tests should be specified?

The discussion was opened by R. W. Mastick, who read an exhaustive discussion submitted by the joint committee on inductive interference and recommended a frequency of at least 1500 cycles for the resonant standard.

L. T. Merwin stated that the practical man would be interested in the paper's proof of the detrimental effect that certain high harmonics may have in bringing about resonance in branches of a power system as well as in affecting nearby telephone systems. These may be overrun by inserting impedances in completed networks and designing future systems so as to obviate such troubles. In case of a simple parallelism with a telephone line a system of transpositions will solve the difficulty. Any standard that may be used as a basis of penalty should apply particularly to the higher frequencies which affect telephone lines.

L. J. Corbett suggested the generator might give a sine wave which would be distorted at various points on the line. H. J. Ryan then discussed the effect of line and load conditions on the harmonics. C. E. Magnusson read W. M. Chubb's discussion endorsing Prof. Bedell's paper.

Replying to a suggestion that harmonics be penalized not in point of order but of frequency, W. D. Peaslee showed the absurdity of such a plan. He criticized the telephone men's reticence in sharing what information was shown by their experiments and the tendency to put the next move up to the power man, whereas it is time for the telephone man to lend his assistance.

In closing the discussion Dr. Bedell stated that any standard which varied with line and load conditions would not be satisfactory. At first only a simple approximation to a standard can be adopted. As engineers become more accustomed to its use a more complex standard may then be tried.

In answer to a query by R. E. Boykin, H. J. Ryan explained that even 0.1 per cent of water renders high grade porcelain insulators defective. At a temperature of 450 degrees C. porcelain has the same conductivity as carbon, no matter what formula is employed in the mix. The composition of the porcelain, however, has a great effect on the porosity.

W. D. Peaslee, in closing the discussion, stated that neither air-break nor oil-break switches are as responsible for the transients as are the characteristics of the line itself. He stated that mechanical

failures of insulators are largely due to the terrific bombardment which takes place in the zone of flux concentration. He suggested that a sphere-gap would be more effective than either a horn-gap or point-gap in filtering out transients. He also urged greater co-operation between the practical power men and the men in the college laboratory.

Insulator Failures Under Transient Voltages. By W. D. Peaslee.

The author of this paper is a consulting engineer of Portland, Oregon. He has had extensive experience in the study of failures of insulators under transient voltages.

The operation of a high-voltage transmission line involves changes in energy distribution that are very conducive to high-frequency disturbances and transients of very steep front. These are often superposed on the normal frequency voltage of the line in such a way as to impose great stresses on the insulators.

The mechanism or failure of an insulator is of great importance to those designing and operating transmission lines. This paper presents the results of recent investigations on the failure of insulators under impact and combined impact and normal-frequency voltages. Microphotographs of the resulting failures are included.

The breakdown of a dielectric involves energy which is a time function and the importance of the duration of the stress in determining the magnitude of the voltage necessary to puncture an insulator is discussed.

Due to the short duration of transients, insulators are often punctured repeatedly by them, the porcelain in the puncture solidifying again on account of the small energy involved. These sealed punctures, however, weaken the insulator, lowering its dielectric strength materially. The importance of the elimination of air holes and defects in the porcelain is shown. Some essential features of a successful line insulator are stated.

J. B. Fiskien questioned the author's statement regarding the harmfulness of air-break switches. His experience has never shown a serious trouble from air-switching. He suggested that a metallic coating in the top of the insulator would minimize disturbances.

Robt. Howes read a discussion demonstrating that this paper would give the user and purchaser of insulators a better understanding of the conditions under which they must work. He cited his long experience where no such failures had resulted and assigned as the reason the fact that he had always insisted upon insulators having a sufficient factor of safety and that he had always located lightning arresters exactly at the terminals of impedances.

L. T. Merwin stated that the problems of the academic men are prophetic of the practical man's problem. He spoke of the value of college laboratories in pointing out the dangers to be expected and urged that these notes of warning be heeded.

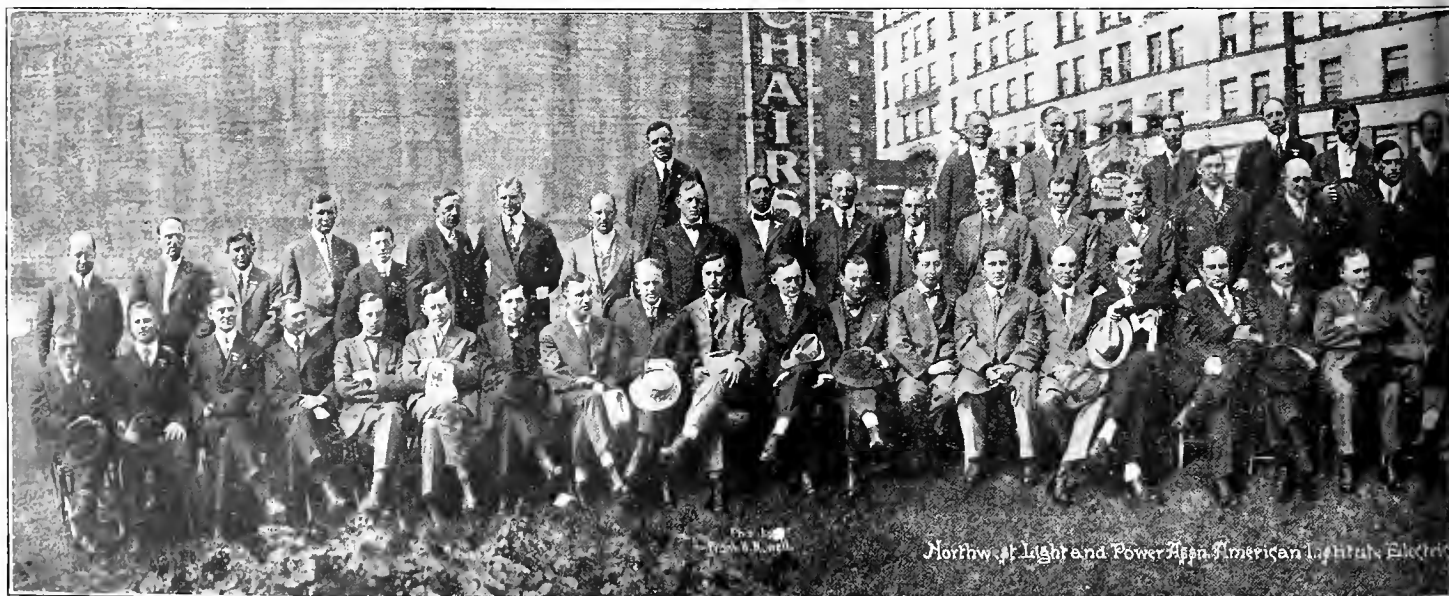
H. J. Ryan stated that the paper gave a correct explanation of the manner in which insulators fail and strongly indorsed the author's conclusions. He stated that in the wet process of producing porcelain the pores cannot be closed by vitification.

R. W. Mastick told of taking 40 or 50 oscillograms of both oil and air-break switches, under load and no-load conditions, at points of switching and at various distances along the transmission line, which showed that the disturbances were not so great nor so sustained with oil as with air break.

J. B. Fiskien cited an equal number of tests showing no material difference between the two types of switch. He was still of the opinion that extreme surging is not caused by air switches.

WATER AND LIGHTING INSTALLATION IN SALVADOR.

The town of Moncagua is to be supplied with water by hydraulic power carrying 21,000 gallons in 24 hours a distance of 3900 ft. and to a height of 160 ft. Other towns installing water systems are San Miguel, Ahuaachapan, Usulután, Sonsonate, and San Juan Nonualco. Electric lighting is being installed in Coatepeque and San Vicente, and acetylene lighting in Metapan and Chalatenango.



The Delegates to the Ninth Annual Convention of The Northwest Electric Light & Power Association and the P

NOTES ON CONVENTION OF N. E. L. & P. ASSOCIATION

The ninth annual convention of the Northwest Electric Light & Power Association at Seattle, Sept. 7-9, 1916, was, in many respects, the most successful yet held. A large attendance and interesting discussion characterized all meetings. The subject of electric ranges, in particular, received much attention. Too much credit cannot be given President E. G. Robinson and his able assistants for the success of the affair.

During the next year the association's activities will be conducted by the following officers, as elected at the close of the session: President, M. C. Osborn, Spokane; Vice-President for Washington, J. S. Thornton, Raymond; Vice-President for Oregon, J. P. Edwards, Tillamook; Vice-President for Idaho, H. B. Waters, Boise. New members executive committee, O. B. Caldwell of Portland and N. W. Brockett of Seattle.

The convention was called to order Wednesday morning by President E. G. Robinson, who introduced Mayor H. C. Gill, who warmly welcomed the power men. After giving fitting response to the welcome President Robinson briefly reviewed the past year's activities. Those who organized the association are still carrying the good work. The affiliation with the National Electric Light Association is proving mutually beneficial and fears of smaller companies have been found to be groundless. He praised the work of the program committee and told of the efforts of the hydroelectric committee on the National Electric Safety Code. He suggested that if the public were properly educated as regards the power companies' side they need have little concern about legislation. He advised the appointment of a permanent secretary and suggested the appointment of a water system committee. The association has 192 members and a balance of \$1743 on hand.

The following papers and discussions were presented during the ensuing sessions:

The Employee as the Educator of the Public.

This paper by Arthur Gunn called attention to the value of good will and suggested how it might be cultivated through the aid of the employee. He urged that the principles of loyalty, sincerity, truth, courtesy and tact be deeply impressed on the minds of all who come in contact with the public. He stated that "the customer is always right from his standpoint."

The discussion was opened by Mr. Jennings who emphasized the importance of loyalty. J. P. Edwards laid stress on the necessity for accuracy of statements from employees. F. O. Broili showed that the assumption that the customer is always right may be the cause of some little trouble. E. G. Robinson cited an instance of success in obtaining a contract for street lighting by yielding a point to the public's demands.

H. J. Gille said that instead of preaching these sentiments to salesmen they should be individually developed in accordance therewith. By showing the salesman that such actions benefit him and are the basis for promotion the company will be eventual gainer.

M. C. Osborn pessimistically discounted the suggestions made in the paper and argued that the company who can deliver the most for the least money has the best friends. He stated that these attempts to conciliate the public cost more than it is worth. He believed that by teaching the public to read their own meters and reducing the cost of current the public will be better satisfied.

S. M. Kennedy disagreed with Mr. Osborn's sentiments. He showed that proper consideration of complaints puts the consumer into a better frame of mind. He held to the theory that each employee is a source of either weakness or strength to the company, with



no half-way ground. The employee who is loyal and courteous to be the one advanced. He believed in taking the employee into the confidence of the management so that he may work intelligently.

Arthur Gunn, in closing the discussion, stated that the thoughts in the paper might be materialized by the exercise of care in the selection of the raw material, by systematic record and comparison of complaints and by treating the new business department as a service department.

Adequate Protection Against the Risks of Obsolescence and Inadequacy.

Leslie Craven here showed obsolescence and inadequacy to be forms of functional depreciation caused by the phenomenally rapid changes in the electrical art, as well as by the growth of cities and improvements required by governmental authority. Functional depreciation is similar to the risk from fire and its dangers have so far been mitigated only increase in value of lands and real estate, "a speculative contingency upon which conservative management cannot rely as a substitute for replacement funds to maintain the integrity of the investment." Rates should be such as to include the accumulation of a sufficient fund to replace the property at the end of its life.

Those entering into the discussion of this excellent paper included Henry Gray, W. R. Phipps, S. M. Kennedy, A. S. Moody, O. B. Coldwell, M. C. Osborn and Leslie Craven. The main point developed was the necessity for statistical records as a basis for estimating functional depreciation, concerning which little is known. The initiative should be taken by the companies and not left to the commissions. There are so many variables that each case should be considered separately, especially as apparatus obsolete for one service may be valuable as a stand-by. A sympathetic understanding of these facts is essential to the success of utility regulation.

The question was here introduced as to what account the cost of concreting pole-butts should be charged. The consensus of opinion was that as this prolongs the life of equipment in service, the expense should be capitalized.

Address by S. M. Kennedy.

S. M. Kennedy of Los Angeles, as the representative of President Wagner of the National Electric Light Association, extended greetings and expressed desire for close co-operation between the national and territorial organizations. He characterized the Northwest Association as the most progressive body in the country as evidenced by the local electric range committee's report being adopted by the national body.

He then briefly explained the situation at Los Angeles where the city had sought to obtain the distributing system of the Southern California Edison Company. As this would leave the company without a load for its generating equipment, any valuation should include an item for severance damage. This principle was recognized in the California Railroad Commission's decision, though the amount allowed was cut one-tenth that claimed by the company. The value set on physical property is practically the same as that claimed by the company. The going value claim was not allowed. Including expenditures since July 1, 1915, the total valuation is nearly seven million dollars. As the bond issue for the Los Angeles municipal distributing system is considerably short of the amount Mr. Kennedy felt that "the Southern California Edison Company will be in business for many years to come."

Overhead Line Construction Rules.

M. T. Crawford briefly discussed the principles involved and the results obtained with rules covering the details of overhead line construction. He suggested that safety would be better promoted if the rules were used in an advisory manner, not being given enforced application to widely varying conditions, and if the laws should be enforced to fixing liability and financial responsibility. The objectionable features of the Washington Public Service Commission rules were pointed out, especially the retroactive requirements for reconstruction. The rules increase construction costs from 10 to 20 per cent for city lines and from 10 to 15 per cent for rural lines. Special stress was laid on the hardships involved in trying to comply first with city ordinances, later with state rules and probably in the future with the National Safety Code. The uncertainty in regard to the permanence of rules for line construction is decidedly objectionable.

Discussion was concerned solely with the proposed National Electric Safety Code. L. T. Merwin stated that the Bureau of Standards' suggestions would undoubtedly be adopted by the various state and city commissions and give assurance of less tampering and fewer changes than in the past. They have the approval of labor organizations. N. W. Brockett made a strong plea for home-rule in such matters and urged that the making of rules for local application be left to local authorities. He pointed out the evils of extending national bureaucratic control over local affairs.

J. B. Fiskien pointed out the improvement in the revised code and showed that its adoption would help the utilities, its clearness of specification and provisions for zone division promising to save the utilities thousands of dollars. The rules are not retroactive and disputes can be referred to the U. S. Bureau of Standards as a board of arbitration which has proved eminently fair in the past.

Others entering into the general discussion included J. D. Scott, F. D. Weber, F. O. Broili, P. A. Bertrand and M. T. Crawford.

Electrical Operating and Merchandizing in Small Towns.

Lewis A. McArthur and C. R. Young explained the organization of sixteen branch offices of the Pacific Power & Light Company through Oregon, Washington and Idaho. The plan is to have a capable man in each town and to give him considerable authority. Store ledgers, time tickets, pay-rolls, meter readings, collections, petty supplies and consumers' ledgers, are all handled at the local offices, with monthly summaries rendered the Portland office. All bills are addressed from a central office, outlook envelopes being used. Audits are frequent. Competitive prize awards are made for the best dressed store windows, best reductions in delinquents outstanding and the smallest comparative store accounts. Merchandizing is preferably done by salesmen, with special emphasis on concentrated campaigns and demonstrations.

John F. Farquhar explained the situation as regards the Washington Water Power Company, which carries on a general wiring, appliance and motor business in all its suburban properties. Specialty salesmen are used. Traveling auditors take inventories of stock twice a year. Stock turnover is made three times annually. Range campaigns have been aggressively conducted.

The discussion took the form of questions which were answered by L. A. McArthur. Postcard bill forms were suggested as being effective. Standardization of sizes as well as of form of office stationery,

etc., was advocated. Petty cash payments are left to the discretion of the local manager.

Public Policy Committee Report.

N. W. Brockett outlined the accomplishments of the public policy committee during the past year. He told of the successful publicity campaign against the "home rule" initiative bill and explained the good points of seven bills passed by the legislature but held up by referendum. As the seven bills will probably be voted on as a whole he urged the support of power companies. They provide that all initiative and recall petitions must be signed at the registration office, an orderly method of direct primary, anti-picketing, enlargement of the Seattle Port Commission, a budget law, property qualification for voters at bond elections, and a certificate of public necessity and convenience for a power company proposing to enter a field already being served. The last named bill was explained in detail and its advantages strongly urged.

As regards new legislation it was suggested as desirable that there should be an extension of time in the requirement for reconstruction of old distributing lines, that jitneys be put under commission regulation and made to assume the responsibilities of a common carrier and that an indeterminate permit bill be passed.

The Engineer and the Public.

Henry Suzzalo, president of the University of Washington traced engineering from its beginning as a military service to its present more private applications. He emphasized the public character of all professional work and the need for a standard of ethics. Other professions deal with human problems while engineers contend with those of nature which he remodels to meet human needs. Resourcefulness, in the speaker's opinion, should be the chief characteristic of engineers, and for this reason universities give them four times the education they need so that they may meet the constantly increasing demands made upon them. If the engineer does not keep growing he meets professional death. The speaker criticized those who hide their little knowledge and urged an exchange of ideas through technical magazines, conventions and post-graduate courses as the best means for developing growth.

Illumination of P. P. I. E.

W. D'A. Ryan delivered an interesting lecture, illustrated by lantern slides, regarding the illumination of the Panama-Pacific International Exposition.

Dr. E. Lester Jones, superintendent of the U. S. Coast and Geodetic Survey, illustrated and described the methods whereby that organization is accomplishing its remarkable results.

A Greater Jovianism.

A. H. Halloran of San Francisco showed the greater Jovianism to be one that is carrying out the task of localizing activity through the means of leagues in individual cities. He showed how the Jovians are a strong factor in bettering public relations and in carrying out the details of such campaigns as are planned by the Society for Electrical Development.

In this connection was explained the heavy sales drive that is to be conducted during America's Electrical Week, December 2-9. The association indorsed the campaigns for the week and pledged its support to the Society.

Voltage Standardization.

M. D. Cooper of the engineering department National Lamp Works of General Electric Company, showed the benefits of limitation of distributing voltages to a few definite figures. Lamps, heating utensils, etc., could thus be manufactured and distributed at less cost and with greater rapidity. The voltage advocated are 110, 115 and 120 because

of their symmetry and because they represent the practice of most central stations.

Electric Range Report.

This report by W. R. Putnam, M. C. Osborn, H. J. Gille, A. C. McMicken, S. V. Walton and S. M. Kennedy, supplemented that presented at the Chicago N. E. L. A. meeting. It treated specifically of advertising, merchandising and water heating. Manufacturers have agreed to devote 60 per cent of their space to general advertising of the advantages of electric cooking and the balance to their own make of range. The Society for Electrical Development is co-operating actively. During the present exploitation period of the range stress should be laid on service selling. As practically all ranges are being sold by central stations they should receive the lowest discounts from the manufacturers. No definite conclusion was reached as to whether the open or enclosed unit is preferable. Many tests have been made but no definite recommendations yet regarding the best method of heating water electrically.

S. M. Kennedy considered the merchandising problem under the head of buying and of selling. Ranges are available from different manufacturers to meet all kinds of demands. The most popular type seems to be one having four burners—800, 1000, 1200 and 1500 watt units—on top of the stove and either a 2-burner oven or preferably two ovens, one for broiling and one for baking. The great requirement is to have sufficient heat quickly. The necessity of keeping down the burner capacity no longer exists, either from the consumer's nor the central station's standpoint. Low price is essential. He entered a strong protest against the license committee's giving a preferential price to the jobber who does not do the development work. This was later followed by a telegram to the committee to the same effect. This objection does not apply to lamp socket appliances, which have already passed the exploitation stage.

To sell ranges the public must be educated by means of advertising, demonstration, personal solicitations and follow-up after purchase. No one of these is sufficient without the others. Advertising should be intelligent; show-rooms are important factors in demonstration, salesmen should be range specialists; follow-up should be thorough.

S. V. Walton told of tests on water heaters made by the Pacific Gas & Electric Company. Many types heat water satisfactorily, but a low rate is essential. At present rates of \$3.50 per kw. this business is not entirely profitable. Immersion heaters showed less radiation loss than circulation types.

The Pacific Gas & Electric Company has sold 160 ranges and 66 water heaters in their non-gas territory by means of special salesmen and lady demonstrators, at an average sales cost of \$25 per range. In all their territory 225 ranges have been sold. The Great Western Power Company sold 473 ranges and 162 water heaters during the past year. At a three cent rate bills average one dollar per person in a family.

Mr. Derge of Salt Lake City told of selling 650 ranges, four-fifths of which was during a concentrated campaign between April 1 and Sept. 1. The most popular ranges are those selling between \$50 and \$65 and consuming between 3500 and 4500 watts.

A. C. McMicken recited the success met with

apartment houses installations. Demonstrators follow up all sales to insure satisfaction and intelligent use. Sales expenses averaged 55 per stove, including delivery.

H. J. Gille read the conclusions of the advertising committee's report as submitted to the Chicago convention. Manufacturers have agreed to feature ranges during America's Electrical Week. He felt that the central stations are weak in advertising and especially in need of proper literature.

M. C. Osborn showed that rates for electric cooking varied from 2c per kw.-hr. at Seattle, to 3½c at Los Angeles, where the Southern California Edison Company has sold 1100 ranges this year. That salesmanship is the deciding factor in range sales, rather than rates, is shown by the fact that municipal plants have sold far fewer ranges than central stations. In Spokane 292 ranges and 102 water heaters have been sold. It costs from \$60 to \$75 to sell and set a range. The consumption averages 129 kw. per range per month.

Mr. Lemmon of Reno has found that 93 per cent of his sales were of the highest price range handled. An electric water heater causes a range to be used more throughout the winter months.

Representatives of various manufacturers produced facts to show that ranges have a diversity factor of 8, that 99 per cent of ranges placed in kitchens stay, consequently that small initial payments are preferable and that even without advertising the demand far exceeded the supply.

Considerable discussion was had regarding the merits of different kinds of boiler insulation, the consensus of opinion seeming to be that the convenience of a laced covering of hair felt being the handiest though not the most efficient. Other insulating materials suggested included pulverized gas coke, sawdust, asbestos and magnesia. It is as important to lag the pipes as the boilers, particularly in circulating systems.

Considerable discussion has attended the use of baffles, though care must be exercised to see that check valve is provided to prevent possibility of boiler explosion.

In general, for water heating as for cooking, quick service was shown to be more essential than limiting the maximum demand. The great diversity of the load will prevent transformers being overworked.

Entertainment Features.

The entertainment by both the Northwest Light & Power Association and the American Institute of Electrical Engineers was conjoined in a most enjoyable fashion. The ladies were given automobile trips and a theater party and the men had a banquet on Friday evening at the New Washington Hotel. N. W. Brockett presided at the latter, introducing as speakers President-elect M. C. Osborn, Dr. Frederick Bedell, S. M. Kennedy, Henry L. Gray, Ralph W. Pope and R. W. Clark.

On Saturday, the ninth, a steam trip was taken around Lake Washington and luncheon served at Fortuna Park, where dancing and sports were indulged in, thus bringing to a pleasant close a most successful convention.

WATER POWER IN SOUTHEASTERN ALASKA.

The streams of Alaska have been important factors in its industrial growth. The success of placer mining in northern and central Alaska has depended primarily on the water available for hydraulicking and dredging, and in southeastern Alaska water power has long been used by mines, canneries, sawmills, and other industries, although until recently most of the plants have been small.

Since 1906 the United States Geological Survey, Department of the Interior, has been making systematic studies of the water resources of Alaska. Lack of definite information in regard to the quantity of water available and other physical factors that determine the feasibility of a power site has been one of the principal impediments to development. For this reason a systematic investigation designed to determine the location of feasible waterpower sites in southeastern Alaska was undertaken by the Geological Survey in co-operation with the Forest Service in the spring of 1915.

As an outcome of this later study a report, prepared by G. H. Canfield, entitled "Waterpower Investigations in Southeastern Alaska," has been recently published by the Geological Survey as part of Bulletin 642. In this bulletin the data collected at gaging stations in southeastern Alaska are given, as well as a general description of each station and tables showing the results of discharge measurements and the computed daily discharge.

A copy of the report, which is included in Bulletin 642-B, may be obtained from the Director of the Geological Survey at Washington, D. C.

PHOTOGRAPHING INTERIOR STRUCTURE OF CONCRETE WORK.

Some successful experiments in photographing the iron reinforcements of concrete work with Roentgen rays, recently made by Inspecting Engineer E. Stettler of the Swiss Railway Department, are attracting much attention among Swiss construction engineers. The advantages of being able to make an examination of the condition of such reinforcements or the proper disposition and situation thereof without destroying the concrete structure are self-evident, as well as the desirability of being able to make an inspection of the position of the reinforcing iron rods upon the completion of the cement parts of a new building or a new cement structure.

Engineer Stettler, by the use of special plates adapted to any construction, has apparently obtained serviceable pictures of the inner structure of cement blocks. To eyes accustomed to pictures with great detail and much light and shadow, the first results of the Roentgen exposure may seem somewhat meager. However, the iron reinforcements in the pictures are shown in their proper size and situation, as also the connections and crossings, so that the imperfect connections can be clearly recognized.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

"What sugar is doing for Cuba" is emphatically shown by the fact that her net profit from this source during the past two years is said to be one quarter of a billion dollars.

* * *

An eastern electric railway signal system has been developed to such a high stage of perfection that only one interruption is recorded to every thirty-seven thousand signal movements.

* * *

At last a good word has been said for American exporters. The London Ironmonger highly praises the superior condition in which American-made pipe recently arrived on the job in Egypt.

* * *

Even the far off Canary Islands are feeling the high advance in prices. The cost of manila paper for the packing of their fruits has advanced thirty-three and one-third per cent since the first of the year.

* * *

It is doubtful whether the recent threatened railroad strike would have proven more disastrous to this country than to the allies who are drawing much of their food stuffs and a vast amount of ammunition and guns from our factories.

* * *

Open air electric railway cars, devoid of roofing are proving popular in Vancouver, B. C. This is the first instance to be noted wherein the conveniences of modern automobile travel are beginning to be met by street railway car design.

* * *

The official report of the Argentine government shows that governmental loan advances to farmers have proved a great success. The fears as to the repayment of the advances made against the security of pledges have proved groundless.

* * *

The Japanese government, having on deposit some fifty millions of dollars in this country for which it receives but one and one-half per cent per annum is about to invest this sum in British treasury bills that yield at present between four or five per cent.

* * *

The Chilean government is advancing vast financial assistance to its nitrate producers. The American government would do well to subsidize in some manner those who would venture into hydroelectric fixation of atmospheric nitrogen at this critical stage of unpreparedness.

* * *

Shipyards the world over are working night and day trying to supply the demand for commercial ships, yet prices for vessels continue to mount to new high records. Preparedness for peace by having a well organized merchant marine is now uppermost in American minds.

The great demand for tungsten has recently led to an extremely energetic development of the tungsten deposits 8 miles west of Bishop, Inyo County, California. The deposits were discovered in 1913, but remained practically unknown until the spring of 1916.

* * *

Reports from loan brokers say that many investors are looking forward to the end of the war and are seeking to invest their money in farm mortgages as a sound security that will not be affected by the readjustment in industrial affairs that is likely to follow peace. This is accounting for the surplus of money offered to brokers, now much larger than loans can be furnished.

* * *

If variety has anything to do with the spice of life as heralded in the ancient proverb, San Francisco's recent bridge hearing certainly proved interesting to the fullest extent. Estimated costs ranged from eleven million dollars to seventy-five million dollars, depending upon the particular design advocated, while cantilevers spanning to Goat Island, tunnels and pontoons added variety in suggestive design.

* * *

The Republic of France, though torn by war, is nevertheless planning a gigantic International Sample Fair for two weeks in March, 1917, to be held at Lyon. A vast system of publicity has been organized throughout the world in order to attract a great throng of buyers. Dealers are strictly forbidden, however, to deliver any article during the period of the fair or to sell any article of goods at retail.

* * *

The Electrical World congratulates San Francisco in a recent editorial upon the three conspicuous things in her beautiful new lighting system. First upon the color tone which is a golden glow instead of the somewhat hard white usually found. Second, upon the free use of arcs in groups upon standards or single units. And third, upon the utilization of railway poles, thus lessening the number of standards in the streets and adding to its decorative possibilities.

* * *

A discovery which may greatly increase the output of pineapples in the Hawaiian Islands has been announced by M. O. Johnson, chemist of the United States experiment station in Honolulu. He has developed a method of neutralizing the action of manganese on pineapples grown on soils heavily impregnated with this mineral. An area variously estimated at 6000 to 10,000 acres on this island has black-top soils which are impregnated with manganese in proportions up to 2 or 3 per cent of the weight per acre-foot. When pineapples are planted on these soils they grow well for a time, but as the harvest time approaches the leaves drop and become yellow. The fruit usually forms, but does not develop properly, and it ripens before attaining full maturity, or, on the worst lands, fruit hardly forms at all.

JOURNAL OF ELECTRICITY

POWER AND GAS

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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To the careful student of modern electrical evolution, two live campaigns in the uses of electrical energy are seen to be the talk and discussion of the hour—namely, the effort to enlarge the use of electric appliances in the home with especial emphasis upon cooking by wire, and the utilization of street lighting to a higher and broader expression in modern business activity.

It is to assist this latter activity that a few words are well in order at this period. A gigantic effort is being made to make America's Electrical week in December an affair long to be recalled in the memories of a nation now possessing over a hundred millions in population. As a typical example of the enormity of publicity that is now being prepared to arouse interest in this undertaking it is estimated that the official poster for America's electrical week will be reproduced over two hundred million times before the period it heralds arrives upon the scene.

The question naturally arises in one's mind "why such enormity of electrical publicity?" The answer comes at once that the average human being, though unfamiliar with the intricate laws and workings of electricity is nevertheless profoundly impressed with its present uses and its future possibilities. Indeed we must all admit the harnessing of the subtle force which drives the lightning bolt or propels intelligence through boundless space without the use of wires expresses more the all-sweeping power of the Almighty himself rather than any possible creation of human hands. It is this strong appeal to the imagination that grips the observer on all sides.

Coming now to the lighting campaigns that are being waged in various cities of the West, we find that this same strong appeal is moving peoples and communities alike. The great rainbow spray of the Panama-Pacific Exposition will long live in the minds of all who beheld its tantalizing splendor. And again a community that bedecks itself in the very latest lighting effects in its business district will leave the same impression upon all beholders.

Finally, then, to clinch the impression in the public mind after a community has completed an installation of marked beauty and merit in electric lighting, the electrical parade, featuring the history and evolution of light from the early dawn of civilization to its present advanced state, makes an imprint upon the public mind so impressive and so all sweeping in its effect that every beholder becomes a booster for the city or community wherein it is held.

From the commercial point of view the electrical parade has overwhelming arguments in its favor for aiding immeasurably in boosting the sales and uses of electrical energy. The inventor beholding it, is led to dream even greater possibilities of electrical application. The general public beholding its beauty become imbued with a keen desire to use more and install more electrical lighting features. The jobber, the contractor, the central station man and the manufacturer, all beholding it realize more and more the possibilities of co-operation in extending the bounds of an ever increasing industry.

The final result is that the electrical parade, well planned and well executed, has features of value to

the development of electrical application and uses not to be equalled in any other single line of activity.

Readers of the Journal undoubtedly found much personal interest in following the announcement given in the issue of September 9th concerning university extension effort at the University of California.

Real Need in University Extension

It is a great source of gratification to taxpayers of the West and indeed to all her well-wishers that the various common-wealths of the Pacific Coast are through their state universities offering opportunities of study by means of extension and correspondence courses that a decade ago were not dreamed of as being possible.

Today literally thousands of young men and women, though deprived of the privilege of attendance at the various state universities are enabled to vastly improve their time by enrolling in some one or more courses in agriculture, languages, literature, public speaking, mathematics, political science, business branches, economics and technology.

Indeed to such an extent has this helping hand been extended that now a farmer producing apples in the snow-capped districts of Montana and Idaho, grapes or alfalfa in the great central basins of Oregon and California, or citrus fruits upon the deserts to the south, knows where he can always find a friend that will assist him to better himself or to solve his problems.

There is, however, one phase of university extension which is sorely needed in the West that to date has been absolutely allowed to pass unnoticed and unnurtured—namely that of assisting the “near engineers” or technical men employed in the industries who are ambitious to better themselves but who find it impossible to devote resident study at the state university.

For instance California today has the most extensive hydroelectric systems in the world. Her production of crude petroleum has passed twenty-five per cent of the entire world's output. Her steam auxiliary central stations are the best examples of efficiency in fuel oil burning to be found in the art. Yet the study of hydraulics, surveying or fuel oil practice is not available through university extension to men engaged in this work. Montana, Idaho and Arizona are today producing in mineral activity records in copper and other ores hitherto unexceeded, yet no opportunity is offered in non-resident study for men engaged in this work to study mine timbering, mine economy or indeed any line of work allied with mining engineering.

It is gratifying to note that announcement has just been made that courses to assist the carpenter, line-man and power plant operator have just been announced by one of our western state universities.

But the work should go further. Other subjects should be included, such as a study of the practical points of industrial installations, the timbering and operation of mines, the laying of foundations, pointers on power plant economy, and indeed all those parts of the engineering curricula which could be set forth with the idea of helping those engaged in this work to the highest degree possible. This work could be care-

fully graded to meet all conditions and types of men that desire it and need it badly. There are many men today proficient in higher mathematical knowledge who can well follow the most intricate mathematical reasoning of the college engineering course, yet who are unable to make university residence to pursue further study.

It is argued that university residence is the only possible way to pursue an engineering course, hence such subjects as those just mentioned which are the crying need of thousands in the West must be reserved for the study of the favored few who can attend the university. Such a hard and fast delineation of university effort will not as a matter of fact stand the test of close scrutiny. It is already being accomplished in certain eastern centers.

The time is coming and it is not far distant either when the public will itself demand that the spaciouly equipped laboratories of western universities be opened, in so far as may be possible, for special class instruction and laboratory exercise to meet the needs of the thousands who are hungering and longing for a helping hand along these directions. That it is impossible for a non-resident man to acquire the highly technicalized standing to be attained by the four or five year resident engineering student is not to be denied. On the other hand, that countless good can be accomplished and that the regular engineering standards of the university can be jealously guarded under properly devised standards of university engineering extension is, too, already an established fact.

We must all admit that fundamentally the conception of a seat of learning is not only to find the truth but to spread the gospel of truth to every quarter possible. Let the engineering faculties of western universities think more seriously over this problem. It is right that they should aim to maintain and equip engineering schools of the highest standard. On the other hand a high sense of duty to the public should urge them, while raising the standards upward, to work downward in spreading the truth to the less fortunate. Indeed by careful thought and planning there should be no hiatus in the acquirement of engineering learning. Throughout the length and breadth of the commonwealth any citizen desirous of improving his opportunities should, if unable to secure the work in local institutions, be able to appeal to the university and receive kindly encouraging help, and not that icy help which says to the young man “some day if you can pass our qualifications in trigonometry, languages and other set points, we will allow you to pursue your course at the university and after four or five years hard resident study grant you an engineering degree. Meanwhile though you could perfect yourself through correspondence in boiler operation, fuel oil burning, hydraulics, surveying and a host of other subjects we teach, still to allow you to do this in part might decrease interest in our regular courses or lower our standard.”

Our state universities are the fountains of learning from which all should be allowed to drink. And no bar or set standard in extension work should be maintained in any of its branches except the ability of the student himself to pursue the work he so greatly desires to undertake.

PERSONALS

W. S. Greenfield, district manager H. W. Johns-Manville Company, of San Francisco, is at San Diego.

W. H. Holabird, an electrical engineer of Los Angeles, is stopping at the Palace Hotel, in San Francisco.

C. C. Hillis, general manager of the Electrical Appliance Company, San Francisco, is on an extended Eastern trip.

L. E. Sperry, sales agent for the New York Insulated Wire Company, is at Salt Lake for a two weeks' outing.

A. F. Dickerson, of the General Electric Company, has just returned from a business trip through the Northwest.

Jos. Sachs, inventor of the Noark Indicating Fuse, from Hartford, Connecticut, is at the Palace Hotel, San Francisco.

W. R. Mongerson, of the firm of Mongerson Electrical Machine Works of Bakersfield, California, is here on a short visit.

T. E. Bibbins, president of the Pacific States Electric Company, is making a business trip throughout the Northwest.

E. M. Cutting, Pacific Coast manager Edison Storage Battery Company, has returned to San Francisco from a trip through Oregon and Washington.

E. Ellis, assistant purchasing agent San Joaquin Light & Power Company, Fresno, stopped at San Francisco for a day on his way home from his vacation.

Arnold Pfau, hydroelectric engineer with the Allis-Chalmers Company, arrived in San Francisco Monday. He expects to make an extended visit on the Coast.

H. B. Squires of the H. B. Squires Company, San Francisco, is away on a pleasure trip to Squaw Camp, Oregon, where he expects to be for the balance of the month.

C. V. Kennedy, formerly of the Los Angeles office of the Pacific Light & Power Corporation, has been made manager of the Oxnard office of the Ventura Power Company.

R. M. Gilson, manager of the Oakland branch of the Pacific States Electric Company, has resigned from that company to enter business with his brother in Oakland.

S. P. Russell, sales manager San Francisco branch of the H. W. Johns-Manville Company, has just returned from a two weeks' business trip throughout Southern California.

C. R. Duncan, formerly manager of the Oxnard office of the Ventura Power Company, has been transferred to the Big Creek plant of the Pacific Light & Power Corporation.

Donald K. Lippincott of the Rieber Laboratories, San Francisco, has been laid up at the hospital with a slight attack of appendicitis. His conditions is reported as much improved.

H. M. Byllesby, president; **J. J. O'Brien**, vice-president, and **W. R. Thompson**, chief engineer of H. M. Byllesby & Co., spent the past two weeks inspecting the company's Pacific Coast properties.

Albert H. Elliott, attorney for the California Association of Electrical Contractors & Dealers, is attending the annual convention of the Washington State Association of Electrical Contractors at Seattle.

H. B. Waters, salesmanager for the Electrical Investment Company of Boise, Idaho, was recently in Jordan Valley, Oregon, looking over the feasibility of extending his company's lines from De Lamar to Jordan Valley.

Chas. H. Carter, for many years associated with the Pacific States Electric Company, both at Los Angeles and San Francisco, has severed his connections with the company and expects soon to go in business for himself.

Frank J. Somers of San Jose and president of the California Association of Electrical Contractors & Jobbers, is representing the California Association at the annual convention of the Washington Contractors' Association.

Henry L. Doherty, president of Henry L. Doherty & Company, of New York, and also president of the Society for Electrical Development, Inc., has announced himself as candidate for the office of the next Fifteenth Jupiter of the Jovian Order. The Jovian Order now number approximately 20,000 members, with 75 local leagues. The present Jupiter, the fourteenth, is Thamos A. Wynne, of Indianapolis, Ind.

W. L. Goodwin, vice-president Pacific States Electric Company, met with a painful accident last Thursday evening while changing the tire of his automobile. Through an oversight the tire had been removed without releasing the air. As soon as the ring was released, the tire exploded, the ring cutting his hand and face severely. He was taken to the Emergency Hospital and later removed to his home. From last reports he was improving very rapidly.

C. E. Groesbeck, general manager of the Utah Power & Light Company, announces that for the present the duties of manager of the Salt Lake division of the company will be combined with those of the general sales manager of the company that **W. R. Putman**, the present general sales manager will assume responsibility of the combined position. Mr. Putman has been with the Utah Power & Light Company in this capacity for the past two and one-half years prior to which time he was connected with various properties in Minnesota and the Dakotas.

D. C. Green, for the past year and a half manager of the Salt Lake division of the Utah Power & Light Company, has resigned his position to accept one as general manager of the Fort Smith Light & Traction Company of Fort Smith, Arkansas. This property is operated by the H. M. Byllesby Company of Chicago. This property furnishes the electric, gas and street railway service of Fort Smith and operates an interurban line between Fort Smith and Van Buren. Before taking his position with the Utah Power & Light Company, Mr. Green had been connected with the Byllesby Company for several years at San Diego, California; Albany, Oregon; Marshfield, Oregon; and Everett, Washington. He graduated from Purdue University in electrical engineering in 1908.

MEETING NOTICES.

The Tenth Annual Convention of the Illuminating Engineering Society of which Dr. C. P. Steinmetz is president, will be held in Philadelphia, Pa., September 18, 19 and 20, 1916, at the Bellevue-Stratford Hotel. Probably no city in the Union could have been chosen to more fittingly celebrate the tenth milestone in the progress of the Society than Philadelphia, which stands pre-eminent in gas and electrical annals. It is interesting to know that the first gas light in America was exhibited in this city in 1796, and Philadelphia was one of the early cities to adopt gas for public street lighting.

Electrical Development and Jovian League.

After a two months' vacation period the first meeting of the fall term was held September 6, 1916. Report of the Preparedness Parade Committee was accepted and placed on file and the committee discharged with a vote of thanks. Letter of acknowledgment from the Los Angeles Jovian League of the resolution passed by the San Francisco Jovians on the death of Mr. J. Harry Pieper was read and ordered placed on file. Mr. Thomas Collins made report for the committee on the Path of Gold Festival, Oct. 4-5, 1916. The business of the meeting being disposed of, Acting President A. M. Alvord turned the meeting over to the chairman of the day, Mr. Henry Bostwick who introduced the speaker, Mr. J. S. Utley, director of the Morris Plan Co. of San Francisco. Mr. Utley explained the objects and purposes of the Morris plan of lending financial assistance to employers and employes, who, by unfortunate combinations of conditions beyond their control were in need of help. One of the main objects of the plan being to keep such persons out of the hands of "loan sharks" with their high rates of interest. Many instances were cited

of the helpfulness of the method in the cities of New York, Philadelphia, Chicago, etc., where it has been in operation for some time.

SAN MATEO CONTRACTORS ORGANIZE.

Some sixteen San Francisco members of the California Association of Electrical Contractors and Dealers paid a flying visit to San Mateo Wednesday evening, September 6th, and assisted the electrical contractors of San Mateo County in the formation of a local branch of the state association for the county. The meeting proved to be a most enthusiastic one, addresses being made by many of the visiting members and local men. From all appearances San Mateo County contractors start out under most favorable conditions.

GENERAL PLANS FOR AMERICA'S ELECTRICAL WEEK.

From December 2 to December 9 all divisions of the electrical industry will combine to make America's Electrical Week the biggest business-getting sales campaign this country has ever experienced.

By means of national magazine, trade paper and newspaper advertising, by means of street car cards, window lithographs, billboards and poster stamps, the "Do It Electrically" message will be carried into every corner of the United States.

Illuminations, parades and electrical shows will command the attention of everybody during the week.

Municipalities will stage great pageants. Individual firms will make their windows and stores so attractive that the casual passer-by will stop, look, buy and become a permanent customer.

Electricity will be the one big topic of conversation during America's Electrical Week—for weeks before and long after. Coming as it does at the beginning of the holiday season a most obvious result will be that people will spend their Christmas money for electrical gifts.

Call it a "campaign," a "big drive," a "united effort"—or just a "week"—it is absolutely certain that this concerted effort by electrical men must result in gratifying returns in business in sales. So, if a "week" of this sort really sells more goods, means more wiring business, more meters connected—and Electrical Prosperity Week last year proved that it does—let's all get behind America's Electrical Week this year and get our share of the profits.

The Name.

The name "America's Electric Week" has been happily chosen. Never before has there been a period in our national life when Americanism has meant more. The industries of America are contending with one another to see which shall do most for the country's good.

The electrical industry can and will take a place of leadership in this broader movement for industrial preparedness commensurate with its position in the forefront of modern progress.

A Start Has Been Made.

Already a big step has been taken toward the goal set for this year's week. Realizing that the design for the week, poster, which will carry the story of A. E. W. into millions of homes, is of the utmost importance, the A. E. W. Executive Committee decided that the surest way to secure a worthy design was to draw upon the ideas of the best artists of the nation.

Consequently a National Electrical Poster Competition has been held as a result of which over 800 posters were submitted. The prize-winning design, which is reproduced on the cover, has been selected by the judges as being not only the best poster from an artistic point of view, but also as best suited to express the purposes of America's Electrical

will be reproduced millions of times. Throughout the entire country, on everything from poster stamp to poster board, this modern Aladdin will be found summoning the genii, "Electricity," to do his bidding.

The original drawings have been exhibited in New York, at the convention of the Associated Advertising Clubs of the World in Philadelphia, at the Poster Advertising Association convention in Atlantic City, in Chicago, Milwaukee and New Orleans. They will be shown in Cleveland, Pittsburgh, Buffalo, Cincinnati, Boston and many other large cities before the week arrives.

TRADE NOTES.

The Edison Storage Battery Supply Company announces that on account of its growing business and insufficient room at 441 Golden Gate avenue, it has secured the entire three floors and basement of building at 206-8-10 First street (near Howard), San Francisco, which it will occupy immediately as office, supply depot and service station.

The Electric Agencies Company, formerly of No. 247 Minna street, San Francisco, has removed to No. 279-283 Minna street, where new and commodious quarters enables the company to handle increasing business with even greater expediency than formerly. Their Los Angeles address has also been changed to No. 419-421 East Third street, former address having been Central building.

Allis-Chalmers Manufacturing Company of San Francisco report recent sales: 5000 kw. alternator, Pacific Light & Power Company of Los Angeles, for their new development near Bishop. Two 500 h.p. motors for Reclamation Service No. 999; 180 h.p. Diesel engine to Sanderson & Porter for the Yarhola Pipe Line Company; 180 h.p. Diesel engine to the Olympic Mines Company, Miner, Nevada.

M. C. Baker & Sons, who have been established in this city for over thirty years, announce that they have recently gone into the technical and practical end in the development of all kinds of model and experimental work, both mechanical and electrical. This company has developed various models, such as quick detachable automobile tire rims and wheels, also electric indicating device for registration of the capacity of the big oil tanks throughout the state, and are now specializing in all classes of electrical devices along the experimental lines.

NEW CATALOGUES AND BULLETINS.

Industrial heating appliances as manufactured by the Westinghouse Electric & Manufacturing Company, are described and illustrated in leaflet No. 3918 just issued by this company. A brief description and some of the uses are given of each of these different devices.

The effects of Vibration in Structure is a preliminary report of the Aberthaw Construction Company in an exhaustive investigation it has undertaken. The report covers twenty-four pages and will prove of much interest to those troubled with vibration of structures.

Bates Steel Pole Treatise is the title of a fifty-page bulletin just issued by the Bates Expanded Steel Truss Company of Chicago whose western agents are the Electrical Material Company of San Francisco. The bulletin has much useful information for the designing engineer covering the various uses of poles in electric transmission.

A 20,000 kw., 11,000 volt, 25 cycle, turbine unit complete with a 24,000 sq. ft. surface condenser and auxiliaries, has recently been ordered by the Pennsylvania Railroad Company from the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This turbine is for installation in the company's Long Island City power house which supplies power for the operation of the Pennsylvania Terminal and



NEWS NOTES



FINANCIAL.

SALEM, ORE.—The net income or profits of the Northwestern Electric Company of Portland during the year ending June 30, totaled \$176,136; operating revenues were \$675,593, and operating expenses \$237,392, making the operating income \$4,383,200.

SALEM, ORE.—The California-Oregon Power Company, operating plants in Southern Oregon cities, sustained a net loss of \$157,045 during the year ending June 30, according to the annual report filed with the State Public Service Commission. Operating revenues were \$402,444 and operating expenses \$328,404. The company had a surplus at the beginning of the year of \$29,925 and the deficit at the end of the year was \$127,351.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company shows an interesting statement of earnings for the twelve months ended July 31, 1916, as follows:

	1916.	1915.	+Increases —Decreases
Gross operating revenue	\$18,609,825.21	\$17,845,000.61	+\$764,824.60
Operating expenses, maintenance, taxes and reserves for casualties, uncollectible accounts and depreciation	10,749,799.87	10,240,751.75	+ 509,048.12
Net operating revenue	\$ 7,860,025.34	\$ 7,604,248.86	+\$255,776.48
Non-operating revenue (net)	472,827.94	340,691.70	+ 132,136.24
Total net income...	\$ 8,332,853.28	\$ 7,994,940.56	+\$387,912.72
Bond and note interest	3,900,718.03	4,061,952.52	— 161,234.49
Bond and note discount and expense (apportionment) ...	171,680.14	292,596.44	-- 120,916.30
Surplus	\$ 4,260,455.11	\$ 3,590,391.60	+\$670,063.51
Dividends on preferred stock — accrued for 12 months	1,253,029.79	902,792.01	+ 350,237.78
Balance	\$ 3,007,425.32	\$ 2,687,599.59	+\$319,825.73

INCORPORATIONS.

EVERETT, WASH.—The Washington Coast Utilities Companies capitalized at \$100,000 has filed articles of incorporation. The incorporators are Warren Marshall and Shirley S. Philbrick of Boston and Charles E. Shepherd of Seattle. Headquarters will be maintained at Arlington, the company to furnish power to towns and corporations.

SPOKANE, WASH.—A company for the development of a natural gas project near Ephrata in Grant county has been formed with an authorized capitalization of \$250,000. Work will be started immediately south of Ephrata. It is planned to sink the shaft to a depth of 1500 ft. at a cost of \$30,000. Paul Donaldson, H. P. Brown, Wm. Clapp and Loren Harris are the incorporators.

LA PINE, ORE.—The Prairie Falls Electric Power Company has been incorporated with a capitalization of \$500,000. The incorporators are F. W. Tomes, E. L. Clark and A. D. Lee, and arrangements for the installation of the first unit of the plant have been made. This unit will develop 2200 horsepower, and will supply power for irrigation in the La Pine district and furnish electric light for Pringle Falls.

ILLUMINATION.

OROVILLE, CAL.—The city contemplates the establishment of a municipal lighting system.

TULARE, CAL.—The Central California Gas Company has plans underway for installing a lighting system in this city.

PETALUMA, CAL.—At a meeting of taxpayers of the Cinnabar District it was decided to install more lights in the district.

LOS ANGELES, CAL.—An ordinance has been adopted for the ornamental lighting of Adams street from Figueroa street to Hoover street.

SACRAMENTO, CAL.—The supervisors have called an election for September 30th to vote on the formation of the North Sacramento Lighting District.

TACOMA, WASH.—Extensions to the gas plants controlled by H. M. Byllesby & Co., of Chicago, are under consideration for Tacoma, Everett and Olympia.

LOS ANGELES, CAL.—The city council has instructed the preparation of an ordinance for the ornamental lighting of Fifty-fifth street, between Budlong and Normandie avenues.

HUNTINGTON BEACH, CAL.—The board of trustees will receive bids up to September 25th for bonds in the sum of \$20,000 for the purpose of constructing a gas distributing system.

PORT ANGELES, WASH.—An issue of city light bonds to the extent of \$22,000 to take up warrant indebtedness and provide funds for needed extensions has been practically decided upon by the city council.

CONNELL, WASH.—Mr. Essex, representing the Spokane & Eastern Trust Company of Spokane, has purchased the municipal bonds of the Connell Water & Lighting System. The city assumed charge of the system.

SANTA BARBARA, CAL.—A resolution has been adopted by the city council for the installation of ornamental lights on State street, between Ocean Boulevard and Victoria street. Protests will be heard at the council chamber on September 21st.

NEWPORT, CAL.—At the request of the attorney general a resolution has been passed by the city trustees, giving the board right to seal the remaining gas bonds without advertising. This will legalize the recent sale of three bids to the State Board of Control.

PALO ALTO, CAL.—The Pacific Gas & Electric Company is building a new pipe line from Redwood City to Palo Alto, According to General Manager Britton, the company is selling gas wholesale to the Palo Alto Gas Company, and the object in building the new line is only to improve the present service.

SEATTLE, WASH.—The following items have been provided in the city budget for the lighting department: Testing machinery, \$3200; supplies and materials, \$100,000; truck, \$5000; overhead wiring, \$10,000; underground cables, \$70,000; pole lines, transformers, meters, lamps, etc., \$275,000; substations, reinforced concrete buildings at Ballard and Fremont, \$75,000.

TRANSMISSION.

REDDING, CAL.—The Northern California Power Company is rebuilding the old power line from French Gulch to Balaklava.

REDLANDS, CAL.—The Southern California Edison Company has leased a room in the Fisher Block, to be used for main offices of the company here.

KLAMATH FALLS, ORE.—The privilege of furnishing electricity to patrons in Klamath Falls will be requested of

the council by the Kene Power Company, who will present to the council a petition for a franchise.

MOGOLLON, N. M.—It is understood that the Pelton Water Wheel Company has the contract for the new hydroelectric plant to be installed on Mineral Creek by the Mogollon Power & Lumber Company. If this plant proves successful, other plants will probably be established in the near future.

LOS ANGELES, CAL.—A resolution has been adopted by the council instructing the city attorney to institute proceedings in the superior court for the condemnation of permanent easement and right of way for the purpose of constructing electric power lines over certain lots in the Porter Land & Water Company's subdivision.

BAKERSFIELD, CAL.—The Southern Sierras Power Company has applied to the board of supervisors of Kern county for a franchise to erect and operate for 50 years, an electric pole, tower and wire system for transmitting electricity for heat and power and other purposes upon the public highways in the county. Sealed bids will be received for the franchise up to October 7th.

ARLINGTON, WASH.—The Jim Creek Water, Light & Power Company has been purchased by Warner Marshall of Boston who has also bought the Stanwood Light & Power Company. Stanwood and Arlington are to be joined by 14½ miles of transmission line and the hydroelectric plant at Arlington used to serve both towns. The Stanwood steam plant will be used as a stand-by.

TELEPHONE AND TELEGRAPH.

JUNEAU, ALASKA.—The Marconi Wireless Telegraph Company is to build a wireless station here.

ROUNDUP, MONT.—The Mountain States Telephone & Telegraph Company will construct an exchange here this season.

HELENA, MONT.—The Lame Jones Telephone Company of Plevna has been incorporated for the purpose of building a line from Plevna to Ekalaka via Lame Jones. Amount of incorporation, \$5000.

SALINAS, CAL.—The board of supervisors has granted the petition of the Indian Valley Telephone Association to build a telephone line from the San Luis Obispo county line northward along the county road to the junction of Peach Tree road.

KINGMAN, ARIZ.—It has been announced by the manager of the Arizona, California & Nevada Telephone Company, that a tentative agreement has been made with the Mt. States Telephone Company for a joint toll line service. Connection is to be made at Ashfork, thus giving Kingman and Mohave county direct long distance service to all parts of the state, coast or any part of the United States.

IRRIGATION.

ATTALIA, WASH.—Farmers of this district have petitioned the county commissioners to establish an irrigation district.

COEUR D'ALENE, IDAHO.—William Dollar has asked for a franchise to distribute hot water, steam and electric current for light and power.

VALE, ORE.—Bids will be received up to October 2 at 2 p. m. by the directors of the Warm Springs Irrigation District for the purchase of \$390,000 in district bonds.

BEND, ORE.—Pringle Fall Electric Company has completed arrangements for the first unit of the power plant which will develop 2200 h.p. to furnish light and power for irrigation for different localities here.

GALT, CAL.—A water takers' association has been organized in the Sheldon District and a committee has been appointed to work with the Herald Water Takers' Association on a plan for the formation of an irrigation district.

SUNNYSIDE, WASH.—The contract for furnishing and erecting wood stave pipe for the Grand View irrigation district has been awarded to the Washington Pipe & Foundry Company of Tacoma at \$18,405.70.

SOUTH BEND, WASH.—Eli Rockey of Bay Center and others are forming a diking district near the mouth of the Palix River. The dike will be 1400 ft. in length and will reclaim 1750 acres of land. The Cowlitz Bridge Company has the contract at \$60,000 for the work.

MACKAY, IDAHO.—A citizens' committee of this place has been presented with a set of plans by the Utah Construction Company for building the Mackay dam to the height of 65 ft. and with a water line of 55 ft. When the plans have been approved by the state engineer and engineer selected by the citizens of Mackay, work will proceed. This is for the completion of the Big Lost River Carey Act project, and the state land board has given its approval.

MALTA, MONT.—Sealed proposals will be received at this place by the United States Reclamation Service up to September 27th for construction of structures on the Milk River project, involving about 10,000 yd. of excavation, 600 cu. yd. reinforced concrete, 1300 sq. yd. paving, placing of 40,000 lb. reinforcing steel, and installing in wooden structures 134,000 ft. lumber. The work is located in the vicinity of Sace and Beaverton, Mont.

SAN FRANCISCO, CAL.—The Western Development Company of San Francisco has applied to the State Water Commission for permission to appropriate 2½ cubic feet per second of the waters of the South Branch of Oregon House Creek, tributary to Dry Creek in Yuba county, for irrigation purposes. By a dam of timber, rock and brush, applicants intend to divert the water to 90 acres of land at a cost of \$500. The works are to be known as the Meadows Lawn Stock Farm Ditch.

SAN FRANCISCO, CAL.—Twenty-six thousand acres in Reclamation District, No. 999, adjoining Ryer Island on the Sacramento River, fourteen miles below Sacramento, are to be leveed and a drainage system installed by a big corporation owning 40,000 acres of delta land in San Joaquin and Contra Costa counties. The drainage will include the installation of pumps and the building of ditches, and will cost \$600,000. Ten huge dredges and two ditching machines will be utilized in the work, which will require two years to complete.

NORTH YAKIMA, WASH.—The following awards have been made by the reclamation service for furnishing power and plumbing equipment for the Grand View irrigation district, Yakima project, under bids opened June 15. Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., \$5900 for electrical apparatus; Pittsburg Transformer Company, Pittsburgh, Pa., \$1152 for transformers; Trump Manufacturing Company, Springfield, Ohio, \$3250 for hydraulic apparatus; S. Morgan Smith Company, York, Pa., \$10,230 for direct pumping unit; The Western Pipe & Steel Company, San Francisco, California, \$2713 for riveted steel pipe; Vulcan Iron Works, Denver, Colo., \$420 for cast iron head gates; Judson Manufacturing Company, San Francisco, Cal., \$397 for trash racks, etc.

PARADISE, CAL.—The board of directors of the Paradise irrigation district at the next meeting will be asked to approve the following plan of work: Building of a dam at Magalia to store 80 ft. of water, and building of the first unit of the distributing system to water all land now planted in the district and new plantings to total 3000 acres. It is estimated this will suffice for the next five years, at the end of which time—or sooner if required—the second unit of the distributing system will be built, covering an additional 3000 acres. When a total of 6000 acres are taking water the third unit of the distributing system will be built and the dam at Magalia raised to the 125 ft. depth of stored water.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEXNumber
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	List.	Sell.
416 90 degree Elbow Coupl., Right Hand..	.18	.25
416 90 degree Elbow Coupl., Left Hand..	.18	.25
417 1/2 in. Elbow Coupl.	.18	.25
417-A 3/4 in. Elbow Coupl.	.22	.25
418 Punch	.039	.05
419 Toggle Bolts		
1/8x4	.075	.10
3/16x4	.085	.10
1/4x4	.09	.15
420 Toggle Bolts.		
5/32x2	.03	.05
5/32x3	.033	.05
5/32x4	.037	.05
Shield	.065	.10
421 Shear	.036	.05
422 Sub Base	.20	.25
423 Sub. Base	.30	.35
424 Clamp	.007	.05
425 Strip	.044	.05
426 Strip	.055	.10
427 Clamp	.011/2	.05
428 Rosette	.35	.40
429 Rosette	.40	.45
430 Rosette	.28	.35
431 Rosette	.25	.30
432 Bushing	.12	.15
433 Clamp	.036	.05
434 Coupling	.045	.10
435 Elbow	.015	.05
436 45 Degree Elbow	.11	.15
437 Flush S.W. Box	.40	.50
438 Flush S.W. Adapter, Single Gang Split		
441 Type	.55	.70
442 Adapter	.55	.60
443 Single Strip	.20	.25
444 2 gang strip	.40	.45
445 3 gang	.60	.70
446 4 gang	.80	.90
447 Plug Plate	.12	.20
448 Blank Plate	.12	.20
451 Push Plate, 1 Gang.	.12	.15
452 Push Plate, 2 Gang.	.24	.30
453 Push Plate, 3 Gang.	.36	.45
461 Rotary Plate, 1 Gang.	.12	.15
462 Rotary Plate, 2 Gang.	.24	.30
463 Rotary Plate, 3 Gang.	.36	.40
470 1/2 in. Keyless Recep., Metal Cap.	.78	.90
471 1/2 in. Keyless Recep., Metal Cap.	.80	1.00
472 1/2 in. Keyless Recep., All Porcelain.	.58	.70
473 1/2 in. Keyless Recep., All Porcelain.	.60	.75
474 3/4 in. Keyless Recep., Metal Cap.	.60	.75
475 3/4 in. Keyless Recep., Metal Cap.	.62	.75
476 3/4 in. Keyless Recep., All Porcelain.	.52	.70
477 3/4 in. Keyless Recep., All Porcelain.	.55	.70

(To be continued.)

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEXNumber
17

	List.	Sell.
333 Metal Moulding and Fittings—Each.	.08	.10
334 Moulding (Based Capping Comp.)	.17	.20
335 Tee	.14	.20
336 Elbow, 90 degrees	.11	.15
337 Elbow, External	.11	.15
338 Elbow, Internal	.11	.15
339 Drop Cord Box	.25	.30
341 Junction Box	.25	.30
342 Snap, SW. Base, 5 Amp.	.25	.30
342-R Snap, SW. Base, 10 Amp.	.25	.30
344 Base Coupling	.025	.05
345 Single Clamp	.007	.05
348 One-Piece Rosette	.09	.15
354 Double Clamp	.015	.05
355 Ground Clamp	.06	.10
356 Keyless Receptacle	.38	.45
360 Attach Plug (Porcelain Plug)	.38	.45
363-A Canopy Adapter Plate, 4 1/2 in. Split Type	.41	.50
363-A Cover for No. 363, Solid Type	.25	.30
363-B Cover for No. 363, Split Type	.15	.20
365 Canopy Base 4 1/2 in.	.17	.20
366 Canopy Base, 6 in.	.35	.45
367 Porcelain Cover for No. 404, 2 Hole	.50	.60
368 Porcelain Cover for No. 404, 3 Hole	.10	.15
369 Wood Moulding Coup.	.15	.20
375 Outlet Box	.20	.25
376 Corner Box	.25	.30
377 Clamp Bush, Single	.03 1/2	.05
378 Porcelain Cover for No. 375, 1 Hole	.10	.15
379 Porcelain Cover for No. 375, 2 Hole	.10	.15
380 Porcelain Cover for No. 375, 3 Hole	.10	.15
381 Porcelain Cover for No. 375, 4 Hole	.10	.15
383 Blank Cover for No. 375	.05	.08
390 Attach, Plug (Porcelain Plug)	.35	.45
390-A Attach Plug (Composition Plug)	.39	.50
391 5 Amp. SP. Snap SW., Non-indicating	.36	.45
392 5 Amp. SP. Snap, SW., Indicating	.39	.45
395 Chain-Pulling Recep., Moulding Type	.64	.75
396 Chain-Pulling Recep., Sub-Base Type	.62	.75
397 Key Recep., Moulding Type	.41	.50
398 Key Recep., Sub-base Type	.39	.45
399 Keyless Recep., Sub-base Type	.27	.35
401 Box Connector, 1/2 in.	.15	.20
401-A Box Connector, 1/2 in.	.20	.25
402 Conduit Coup., 1/2 in.	.15	.20
402-A Conduit Coup., 3/4 in.	.20	.25
403 Elbow Coup., 1/2 in.	.18	.25
403-A Elbow Coup., 3/4 in.	.22	.25
404 Open Work Coup.	.18	.25
405 Cond. to Mould Tee	.35	.45
405-A Cond. to Mould Tee	.40	.50
410 Fixture Box	.35	.45
411 Moulding to Cond. Tee, 1/2 in.	.25	.30
411-A Moulding to Cond. Tee, 3/4 in.	.30	.35
414 Armored Cable Coup.	.20	.25

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VOL. XXXVII No. 13

SAN FRANCISCO, SEPTEMBER 23, 1916

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BY L. E. CHILDS.

RAINFALL AND AGRICULTURAL POWER USE.

BY S. B. SHAW.

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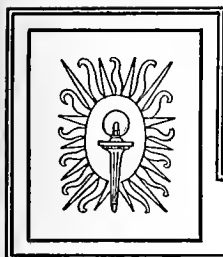


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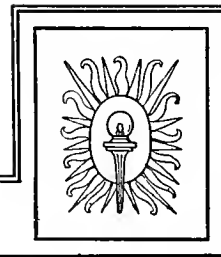
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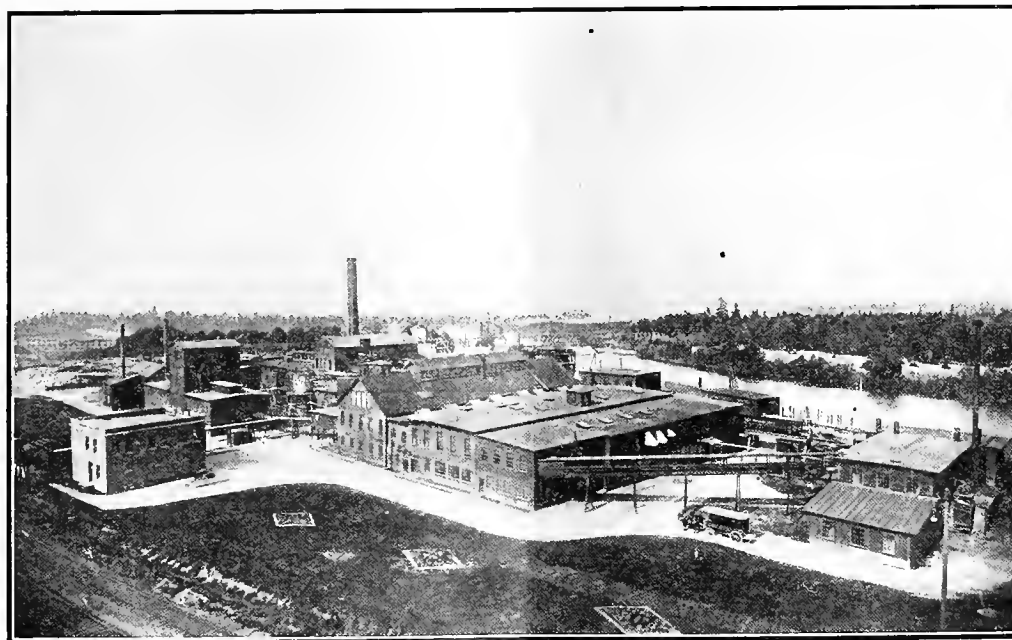
THE EVERETT PULP AND PAPER COMPANY'S PLANT

BY L. E. CHILDS.

(This interesting account of the process of making paper is suggestive of the great field for application of electric power offered by the industry, not only in the machine drive but in the manufacture of chemicals employed. This article is reprinted from the Puget Sound Electric Journal of the Puget Sound Traction, Light & Power Co., Seattle.—The Editor.)

There are five paper mills in the State of Washington. One of the largest is that of the Everett Pulp and Paper Company, at Everett. This company employs some 200 people, and the plant represents an investment of \$750,000.

into smaller pieces with a steam splitter. All material must be from sound timber, and no wood is accepted from which the bark was not taken during the peeling season, as a small quantity of bark will make specks in the paper. Throughout the woodyard is a narrow



General View Everett Pulp & Paper Company's Plant at Everett, Washington.

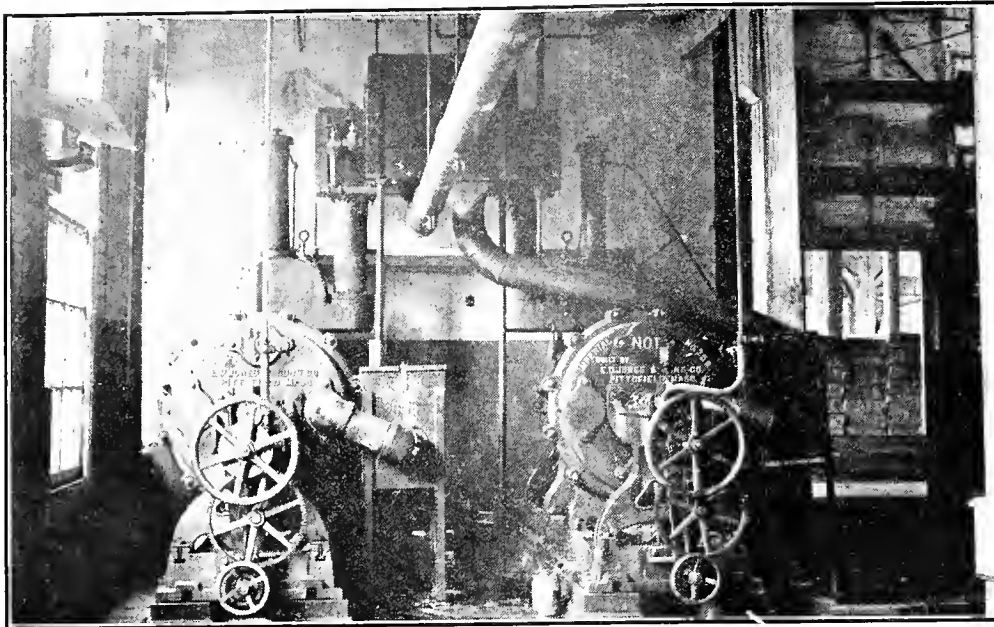
The raw material used by the mill is Douglas fir, spruce and cottonwood. It is treated by the soda or alkali process.

While the company has thousands of acres of timber lands, the wood now used is purchased. Most of the spruce and cottonwood comes from the Grays Harbor country, but the fir is obtained in Snohomish county.

Nearly all the cord wood is delivered at the mill in 4½ ft. lengths, and this wood is piled in high piles in the woodyard. The supply obtained in long form is sawed into cord wood lengths by a drag saw, and split

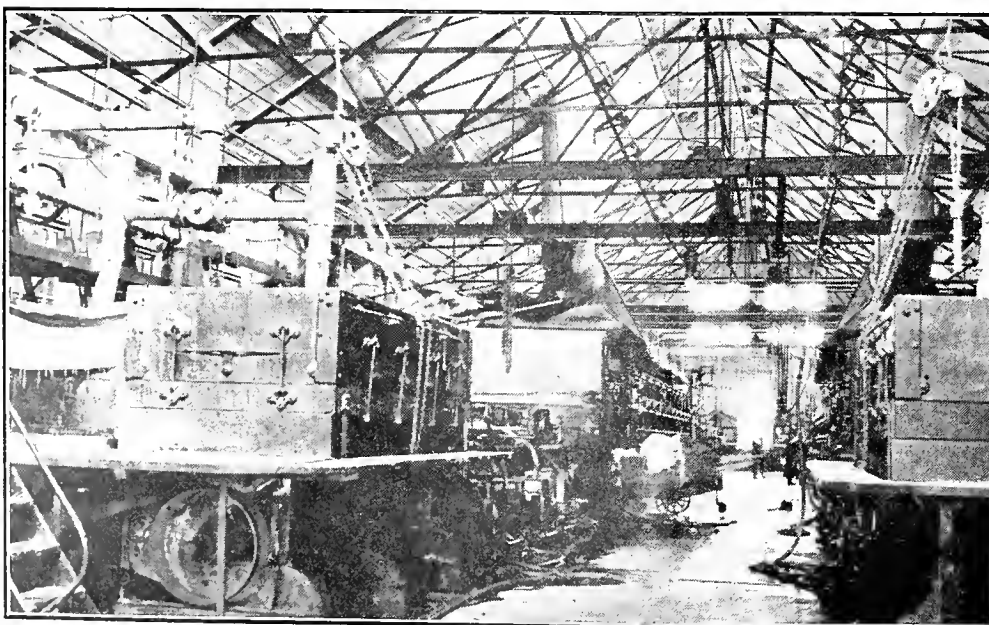
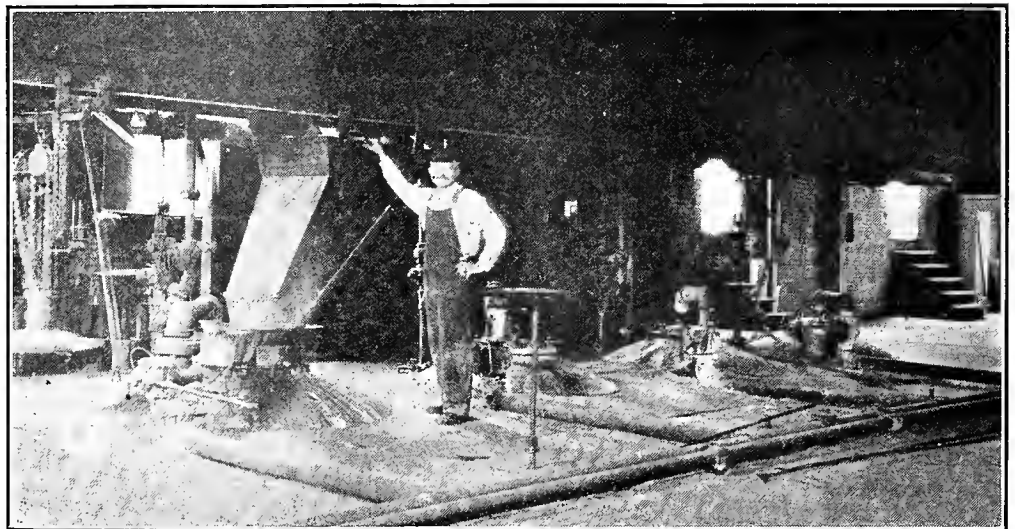
gauge track on which the wood cars, holding 1½ cords of wood, are hauled to the sorting trough. It is here the different species are mixed in desired proportions according to the grade of paper to be made.

The sticks passing through the trough on an endless chain, under showers of hot water to wash off all dirt and foreign matter, are conveyed to the chipper room. They are then dropped against knives set into the face of a heavy, rapidly revolving steel disc, and are cut into chips at the rate of one cord in ten minutes. These chips, about five-eighths of an inch long are then screened to remove sawdust and con-



200 h.p. Motor
Driven Jordans.

Digester Room.
Filling Digesters
from Bins.



Paper Machines.
Stock Chests in
Foreground.

veyed to bins in the digester room, to be cooked in caustic soda liquor.

The plant has six digesters, each a seamless steel boiler, cylindrical in shape, 7 ft. in diameter and 28 ft. high, with curved conical top and bottom.

The charging of both wood and liquor is done from the top. A steam inlet also enters from the top, and when the digester is completely filled with wood and liquor the manhole cover is put in place and the steam turned on (boiler pressure 120 pounds). Cooking continues about nine hours under this pressure, the soda solution dissolving the gums and resinous matter, leaving the former chips a mass of pure cellulose. This mass is discharged into a large steel tank with perforated bottom, where the pulp is washed with boiling water to remove all traces of soda solution. The liquor is now of a dark brown color, due to pitch extracted from the wood. The pulp, still retaining all impurities and undigested pieces of wood, is pumped from the washing tanks to a series of screens and riffle-boxes where sand, knots, etc., are removed.

After passing over a decker to remove a greater part of the remaining water, the pulp is conveyed to the bleaching tanks. A solution of chloride of lime is used to bleach the fibres to a white color. If a very white color is desired sulphuric acid is added. The stock is then pumped to the drain tanks, consisting of large wooden vats with perforated brick bottoms, through which the bleaching liquor drains.

The pulp is now free from all traces of chemicals used in cooking and bleaching, and is pumped directly to small tubs called "beaters" where it is beaten by a rapidly revolving roll. All ingredients necessary to make a sheet of paper are now added. These consist of (a) white clay, used to fill up the spaces between the fibres in a sheet of paper, giving the sheet a soft, smooth finish necessary for printing; (b) sizing, which is a resinous solution added to make the sheet water-proof so ink will not run; (c) alum, which precipitates the resin in the size onto the fibre; (d) analine or other dyes to give the paper the required color.

The pulp as it comes from the beater is now ready to be made into paper. But is first put through refining engines or "Jordans" and thoroughly trituated, and then pumped to the "stock chests" ready for the paper machines. In these refining engines the beater roll is a conical shaped drum carrying knives, which revolves inside a conical shell completely lined with fixed knives. This process cuts the fibres into the desired lengths, but the effect is to tear rather than cut them.

At the paper machines the pulpy mass flows on to an endless brass wire cloth (60 ft. long and of very fine mesh). A large amount of the water in the pulp passes through this screen, which travels at the rate of 50 to 600 ft. a minute, the speed depending on the quality and weight of the sheet of paper to be made. At the farther end of the moving wire cloth the wet web of paper leaves the wire and is carried forward on soft, endless, woolen felts under heavy rolls, where most of the water is pressed out. The newly formed sheet now passes over revolving iron cylinders, heated with steam, where it is thoroughly dried, then between heavy steel rolls or calendars, where the paper receives a smooth surface.

These paper machines, which really complete the process of paper making, are required to be operated at a variable speed due to the different weights of paper produced on different runs. Accordingly each machine is driven by a 130 h.p. Corliss engine through cone pulleys, and the exhaust steam from the engines heats the drying rolls.

If the paper is wanted in sheets it is run through cutters and cut into lengths and widths as ordered. In the finishing room are supercalenders, trimmers, ruling machines, folding machines and numbering machines, and printing equipment. The finished product is marketed as tablets, writing pads and a wide variety of stationers' stock.

The average daily output of the mill is 35 tons of paper, about 60 per cent of the finished product going to California and the remaining 40 per cent being consumed in Oregon and Washington.

The main mill of the Everett Pulp and Paper Company operates twenty-four hours a day and six days a week. The chipper, sawmill and supercalender departments work ten hours. No stock is carried, all machines operating on actual orders.

Power Supply.

The plant of the Everett Pulp and Paper Company with the exception of the paper machines above mentioned, is entirely motor driven. There are 77 motors ranging in size from 1 to 200 h.p., and making a total connected load of 2040.5 h.p.

Power to operate these motors was formerly supplied by a 500 kw. steam turbine. In the summer of 1912, due to the continually increasing load on the turbine it became evident that one of three things must be done. Either the 500 kw. turbine must be replaced by a larger machine, a second turbine must be added, or power must be purchased to operate the mill. The engineers of the paper company were at first somewhat skeptical as to the idea of purchasing power. Their power production costs were already very low since their plant was operating under a high load factor; moreover crude oil purchased in large quantities at a very low cost per barrel was used for fuel, and every refinement making for power plant economy was being observed. An extended test would be necessary before the question of purchased power could be definitely decided.

Accordingly, the power company arranged for the necessary service and a temporary power contract was entered into, it being understood that this contract would be made permanent providing the tests showed a saving in cost of operation. In conducting the tests the mill was operated for twenty-two days, on purchased power, and then for twenty-two days on steam turbine power, and during each period the output in tons of paper was practically the same, thus allowing a comparison in cost of power per ton of paper.

At the conclusion of the tests the results were sufficiently satisfactory to the management of the paper company, that they entered into a long term contract for the purchase of electric energy to operate the mill.

At the present time the power demand of the mill amounts to 900 to 1000 kw. and the load factor from 75 to 80 per cent.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

RAINFALL AND AGRICULTURAL POWER USE

BY S. B. SHAW.*

In connection with an investigation into the characteristics of the agricultural load from the central station point of view, recently conducted covering that part of the territory known as the Santa Clara Valley of California, some interesting features were discovered.

Briefly, there are some 14,000 horsepower in electric motors used for pumping water for the irrigation of various agricultural and horticultural lands in this vicinity. The plants vary in size from 5 to 100 h.p. and the water plane is about 50 ft. below the surface, pumping being principally from wells.

The amount of power used per h.p., or the annual load factor of the average plant, was found to vary to a considerable extent from year to year, and depending principally upon the amount of rainfall. Of course other influences were partly responsible for these variations, such for instance as temperature and atmospheric conditions, and also the amount of the crop in view for the approaching season.

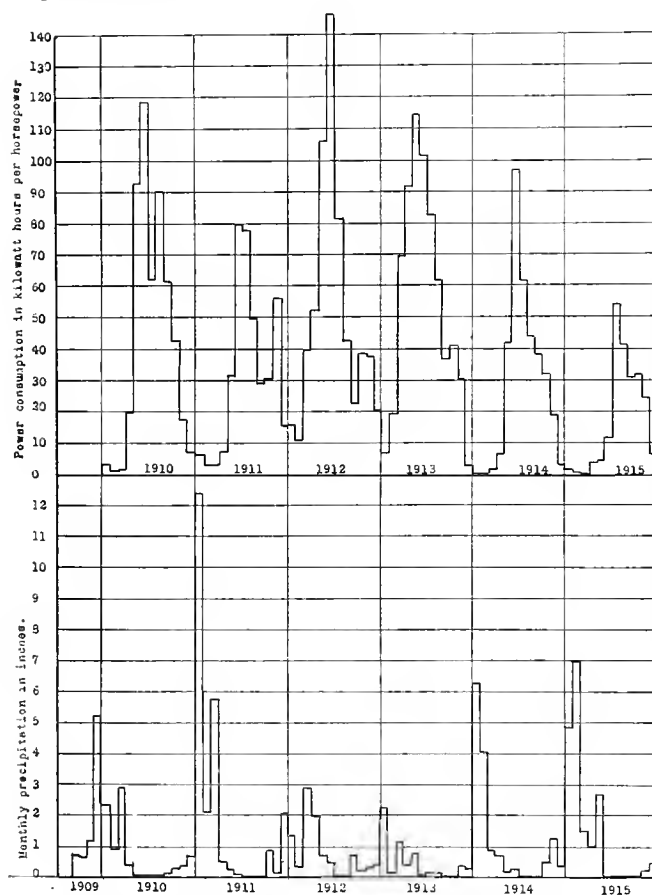


Fig. 1. Monthly Power Consumption and Rainfall.

To ascertain, if possible, the effect of the amount of rainfall and of its distribution throughout the season upon the consumption of electric energy by the irrigation plants, an investigation was made of the annual consumption per h.p. of a large number of plants, and covering a period of several years. From the records of the U. S. Weather Bureau, the precipi-

tation in this territory was obtained. The data as mentioned above are shown graphically in Fig. 1. It will be seen that the data on consumption are based on the number of kilowatt-hours used per horsepower of capacity per annum. Assuming a motor efficiency of 85 per cent, on the above basis, a load factor of 100 per cent per annum would mean a use per h.p. equal to about 7700 kw.-hr. per year.

The amount of rain falling in a certain season influences the agricultural load in the succeeding months; thus when there is a season of heavy rainfall it is followed by a season of proportionally light irrigation, and therefore of poor load factor on pumping plants, and vice versa.

The time at which the rainfall occurs is also of importance. Thus early fall rains during the months of September, October and November will cause a rapid decrease in the pumping load at that time, while the late spring rains in March, April and May will similarly delay the rise of the spring peak, both of which result in a decreased load factor and decreased total consumption.

A concentration of the precipitation during the months of December, January and February results in less penetration and replenishment of ground water and a greater run-off. This will result in an increase in the total annual consumption and load factor. Such a condition is to be noted as occurring in 1911, in which year, although the total seasonal rainfall exceeded that of 1914, the load factor was higher in the former year, probably owing to unusually heavy rainfall of 12.38 inches occurring in January, which was not very effective for the agriculturalist.

After trying various methods of representing the relation between the rainfall and the load factor, the most logical seemed to be that shown by Fig. 2, being the relation between the kw.-hr. consumed per h.p. per annum and the precipitation in inches during the rainy season from July 1st to July 1st, to which is added

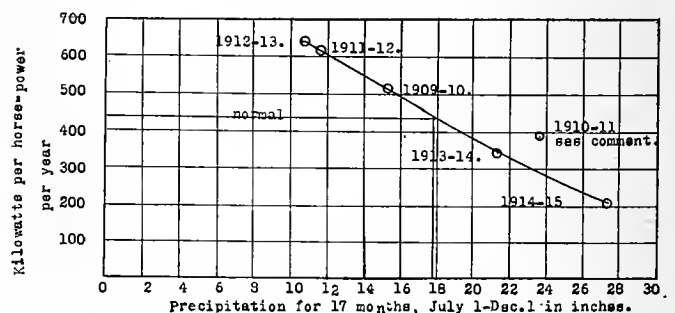


Fig. 2. Relation of Use of Power to Precipitation for Seventeen Month Period.

the rainfall for the succeeding five months to December 1st. Thus in 1914 the energy consumption averaged 342.4 kw.-hr. per h.p. installed. The rainfall during the preceding season from July 1, 1913, to July 1, 1914, was 19.42 inches, while in the succeeding five months, to December 1, 1914, the precipitation amounted 1.86 inches—aggregating for the seventeen months' period a precipitation of 21.28 inches. In this

*Valuation Department Pacific Gas & Electric Company.

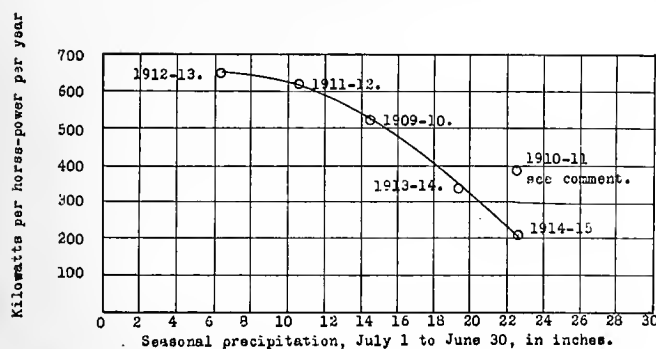


Fig. 3. Relation of Use of Power to Precipitation for One Year.

manner compensation is made for decrease in load factor due to fall rains. Fig. 3 is a curve similar to Fig. 2, except that the rainfall for such twelve months' period has been plotted against the consumption for the corresponding twelve months' period. This, as may be seen, results in a fairly regular curve, with the exception of the variation occurring in 1911, as above noted. Fig. 4 shows the growth of the agricultural power load in these years.

Using the above curves and conclusions derived from them, an attempt was made to estimate what might be termed normal use of energy. In other words, to determine the amount of energy used per horsepower that might be reasonably expected as an average per year over a long period of years.

The following method was used in this procedure: Considering a year of normal rainfall, as determined from the reports of the United States Weather Bureau—the precipitation for the seventeen months' period is 17.82 inches. Applying this to the above curve of rainfall and consumption, we find that the normal average consumption for San Jose, the county territory, is about 435 kw.-hr. per h.p. per annum.

The following is a tabulation of the above data:

TABLE I.
Relation of Precipitation to Consumption.
Santa Clara County (San Jose.)

Season—	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	Normal, 41 yr. Period.
Precipitation (in.)							
Seasonal	14.50	22.65	10.58	6.35	19.42	22.71	15.23
July 1, Dec. 1....	.57	.98	1.21	4.29	1.86	4.62	2.59
Total 17 months..	15.07	23.63	11.79	10.64	21.28	27.33	17.82
Annual energy Cons. kw.-hrs.							
per h.p.....	514.00	386.00	615.00	648.00	342.00	209.00	435.00

This, then may be stated as the probable average use per h.p. of connected load for this territory, so long as it maintains its present load characteristics. Of course, new methods of irrigation or radical changes in use of land might entirely alter conditions and render the above conclusions valueless.

It is certain, however, that results derived in the above manner, or some such similar way, are more to be credited as being representative of average conditions than an average based on two or three years' figures, as has been sometimes used.

It might be interesting to here note the variation of this character of load during the several months of the year. The monthly distribution of load is well shown in the following table, based on six years' data for this territory. The percent of the total annual consumption per h.p. occurring each month is shown, together with the average for the six years' period.

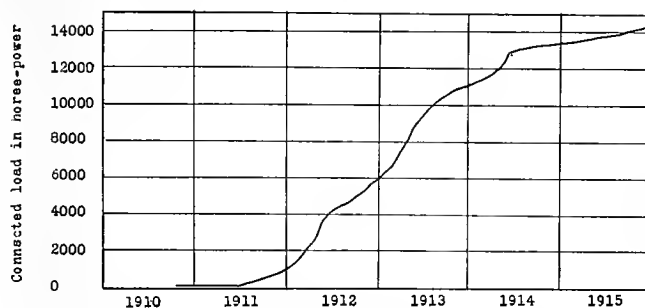


Fig. 4. Growth of Agricultural Load in Santa Clara Valley.

These values probably represent a fairly good average, although the annual rainfall and consumption is a little above "normal" for these six years.

TABLE II.
Monthly Distribution of Agricultural Power Load—Santa Clara Valley.

	—Kilowatt Hours per h.p. per Month.—						Per cent per
	1910.	1911.	1912.	1913.	1914.	1915.	Total. Month.
January ..	3.06	5.90	15.60	6.6	.7	.6	32.46 1.20
February ..	.90	3.60	10.70	19.2	.7	.4	35.50 1.31
March	1.42	3.54	39.80	69.3	1.6	.5	116.16 4.28
April	19.60	6.06	56.80	91.2	6.2	3.2	183.06 6.75
May	93.50	30.60	105.80	114.0	41.5	4.3	389.70 14.36
June	118.20	80.00	145.80	101.5	96.7	12.3	554.50 20.40
July	61.50	78.30	81.80	93.0	60.9	54.1	419.60 15.44
August	89.40	48.70	42.00	61.3	43.2	41.0	325.60 12.00
September ..	60.90	27.90	22.30	35.3	37.8	30.5	214.70 7.90
October....	42.60	29.85	37.80	40.1	31.7	31.6	213.65 7.86
November..	16.50	56.35	36.40	33.9	17.4	24.4	174.95 6.45
December..	6.06	15.05	20.00	2.8	4.0	6.5	54.41 2.05
Average	513.64	385.85	614.80	648.2	342.4	209.4	2714.29 100.00

Average 452.38

LETTER TO THE EDITOR.

Porous Porcelain.

Sir: Will you kindly publish the following in your next issue as an amendment to the report of my discussion of the Flaherty paper on "High Voltage Insulators," Seattle meeting, that appeared on page 224 of the September 16, 1916, issue of the Journal?

Porous porcelain is an important cause of insulator failures. For high voltage insulators the porosity must be within one-tenth per cent; how much we do not know as yet. Porcelain rapidly loses its dielectric strength (against puncture) at temperatures above 100 deg. C. It virtually loses its insulating quality and becomes an electrolytic conductor at 450 deg. C. See Trans. Am. Ceramic Soc., Vol. VIII, p. 472. It has a surprisingly high resistivity-temperature coefficient through common temperature ranges. The chairman of our committee, on looking at the curve sheets, remarked that the porcelain shows a "falling off in resistance of 99 per cent for approximately 45 deg. rise, C."

Fused quartz has many dependable qualities as an insulator. It withstands arcs and corona discharges much better than porcelain. Quartz arrow heads, found abundantly in the soil of Lake County, California, have keen edges and sharp corners. The present Indians in that locality cannot make them. They have the tradition that they were not made by man. Being a lost art, therefore, they must have been made a long time ago. There is evidence here of the validity of the claim of the geologist that an earth product must be non-porous, tough and refractory in order to be stable and to withstand the action of the elements.

HARRIS J. RYAN.

Stanford University, Sept. 19, 1916.

ELECTRIFICATION OF THE OREGON PORTLAND CEMENT COMPANY.

BY D. C. FINDLAY.
(Concluded.)

Fig. 5 is a photograph of the switchboard, which is divided into nine panels. Natural black slate was used, and the oil switches were mounted on a framework and operated by bell cranks and lever under the floor, leaving a clear passage behind the switchboard. Single pole unfused knife switches were

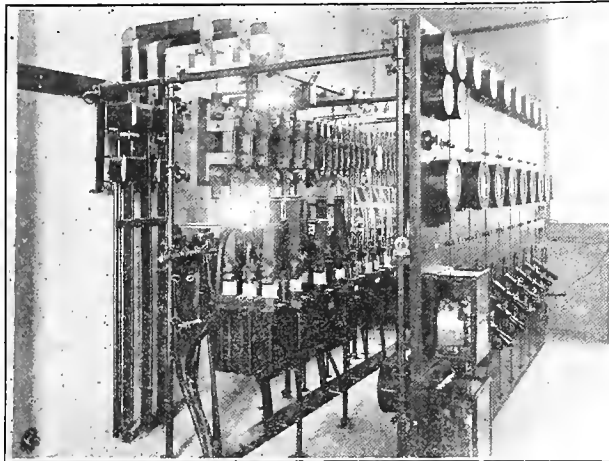


Fig. 5. Switchboard.

mounted between the busbars and the oil switch on each panel, so that each department can be cut clear of the board without disturbing any of the remaining circuits. Current transformers on the two outside legs of each circuit are used for the indicating and integrating wattmeters on each panel, which has an inverse time limit overload relay. By means of these instruments a record is obtained each day. The totalling panel has the following instruments, an ammeter with 3000 ampere scale, and an ammeter switch for measuring all three phases, an indicating wattmeter, power factor meter, and voltmeter, also a Bristol recording voltmeter, and two curve drawing wattmeters, one belonging to the power company and the other to the cement company.

The power is purchased on a basis of maximum demand for a 20 minute peak and one meter checks

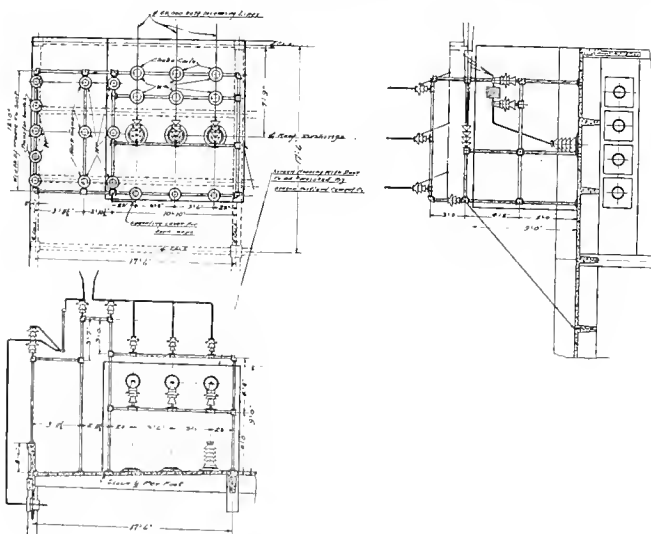


Fig. 7. Roof Construction for Insulators.

against the other. The power company also has an integrating wattmeter mounted on the back of the board.

The lighting is handled by two 10 kw. 440-110 volt transformers in open delta in the basement connected to 10 single pole knife switches mounted on the lighting panel each switch controlling one department in the mill.

The station is protected by a bank of 4 tank electrolytic aluminum cell lightning arresters, which are



Fig. 6. Cement Tube Mill Motor with Lenix Drive.

mounted inside the station, but with the horn gaps, and transfer switch on the roof of the substation, shown in Fig. 7, these arresters are charged 3 times daily. A private telephone system connects directly with the load dispatcher in Portland.

The entire distribution system is underground. All power and lighting cables pass directly from the switchboard into a cable tunnel which runs in the form of a "T" for 300 ft. The heavy power feeders, varying from 400,000 to 1,000,000 c.m. are carried on insulators, supported by galvanized iron pipe frames built into the concrete walls of the tunnel which is 5 ft. wide by 5 ft. high and is waterproof.

All remaining power and lighting circuits are in conduit carried by the pipe frames the entire system insuring absolute safety against interruption of service. All service taps are taken off in conduit, buried in the concrete directly to the distributing compensator structures in each department.

Each department has all starting compensators assembled together on a structural steel frame from which the various motor circuits radiate in conduit. The accompanying photographs show two of these structures. Westinghouse Type E dustproof compen-

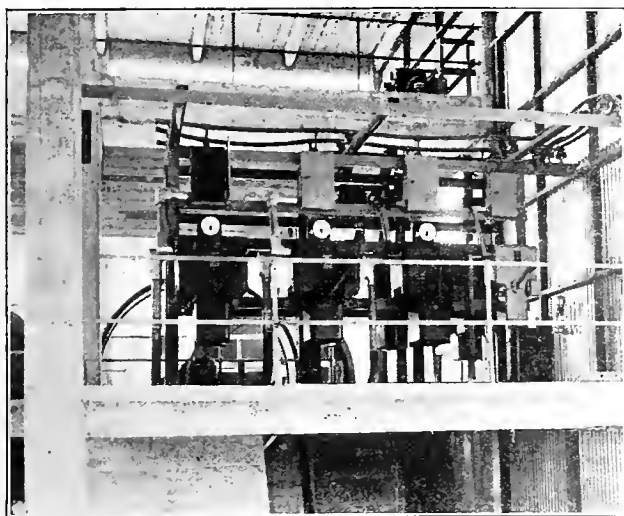


Fig. 8. Electrical Control for Raw Grinding.

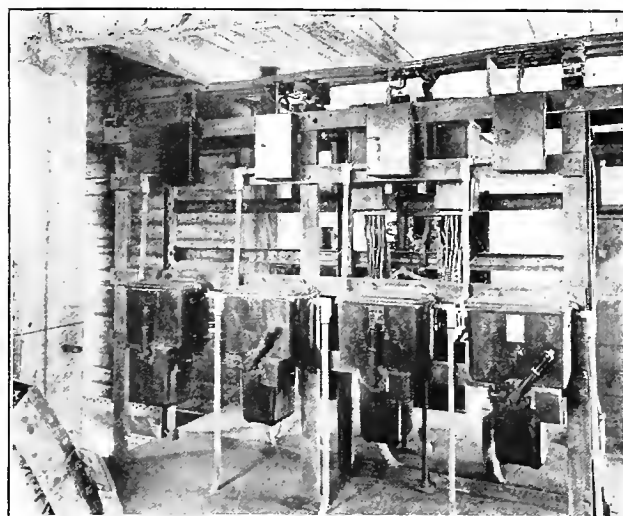


Fig. 9. Centralized Control for Cement Grinding.

sators were used throughout, having conduit entrance and conduit outlet bushings, and each compensator provided with an ammeter for all sizes above 75 h.p., as shown in Figs. 8 and 9.

The main circuit from the cable tunnel forms a busbar running horizontally above the system, from which taps are taken through 3-pole unfused knife switches, in steel cabinets, whose functions are to disconnect each motor for repairs, or when not in service. Each compensator has automatic inverse time limit relays, and also no voltage relays inside the case and protected from any dust. A novel feature of the installation is that every motor has a 600 volt snap switch located directly at the motor, and connected to the low voltage release coil of the compensator by No. 14 duplex cable, so that the operator can open this circuit, and shut down the motor, without taking time to go to the board, in case of emergency. This system of concentrated control allows one operator to stop or start some 700 h.p. in motors without moving more than 10 ft., and in a very short space of time. It also saves greatly in copper. The total power consumption is about 1200 h.p., using 15,000 kw.-hr. daily.

A brief description of the manufacture of Portland cement may be of interest. Two kinds of rock are used, lime rock from Roseburg, Oregon, running about 96 per cent Ca CO_3 and a cement rock from Dallas, Oregon, about 60 per cent.

A 75 h.p. Westinghouse squirrel cage motor drives a $7\frac{1}{2}$ Austin gyratory crusher and the rock is elevated and stored in 10 circular reinforced concrete storage bins 69 ft. high and 22 ft. in diameter with 6 in. walls. These bins hold 12,000 tons. A belt conveyor in a tunnel draws the rock off and it is elevated and discharged into feed bins over the kominuter. In this mill the proportioning of the two rocks is done by two automatic feeders discharging into the kominuter into which a stream of water is also fed. This mill is driven by a 150 h.p. motor with Lenix drive.

The final grinding is done in two cylpeb tube mills using small steel cylpebs and driven by 200 h.p. motors with Lenix drives. These mills take their feed from a reinforced concrete feed trough which was built as a unit with the floor beams, and has an agitating

shaft and paddles. The walls are only 4 in. thick but are watertight.

Three circular correcting basins 24 ft. in diameter allow the chemist to vary his feed till he gets 76.6 per cent Ca CO_3 when mixed in the agitating basin below. The Ingersoll Rand air lift pumping system is used for pumping the slurry over to the 2000 barrel reinforced concrete storage basin under the kiln.

A mechanical feeder lifts out a definite amount of slurry each revolution and feeds it into the rotary kiln which is 210 ft. long by 9 ft. and 10 ft. in diameter, being the largest kiln on the Pacific Coast. It rests on five tires and weighs about 500 tons and is driven by a 75 h.p. variable speed motor, under the burners control. Crude oil is used with air at 2 pounds pressure for atomizing and it requires approximately 8.4 gallons of oil per barrel which is lower than the average consumption. The kiln is rated at 1000 barrels but easily produces 1200 barrels per day and requires only two men to operate on each shift.

The clinker is cooled by a Smidth horizontal pressure cooler, using a blast of air from a 12 foot diameter pressure fan. Another novelty in this plant is the method of handling this clinker, using No. 480 drag conveyor chain in a cast iron lined, reinforced concrete trough, and discharging into a reinforced concrete elevator leg from which a belt conveyor takes it to circular storage bins holding 6600 barrels each.

In this condition as soon as the clinker is ground fine enough, it becomes the finished cement. A kominuter and 22 ft. tube mill in the grinding department grinds 1200 barrels per day with two men on each shift of 12 hours each.

The tube mill is driven by a 250 h.p. motor with Lenix and a 24 in. belt and is shown in Fig. 6.

From the storage bins which are of reinforced concrete the cement is drawn off and packed into sacks as required. About 40 men only are required to produce 1200 barrels daily of "Oregon" brand, exclusive of the quarries.

R. P. Butchart, Victoria, B. C., is president of the company, L. C. Newlands is superintendent and D. C. Findlay, chief engineer, who has designed and supervised the entire civil, electrical and mechanical construction.

HOW TO SELL AN IDEA.

By an Electric Range Salesman.

It's almost impossible to sell an electric stove.

It's easy to sell the idea of electric cooking.

So long as you stick to stove selling, you may be sure that electric cooking, as a practical part of house-keeping, will make slow progress.

The kodak people don't sell cameras; they sell "The Witchery of Kodakry," that is, the idea of picture-making.

The automobile people don't sell a gasoline engine on wheels; they sell the idea of luxurious motion.

The phonograph people don't sell a spring motor and an intricate mechanism for reproducing vibration; they sell the idea of ready-made music.

The real estate promoter doesn't sell a quantity of brick, mortar, joists and shingles; he sells the idea of a home.

The manufacturer selling a "Hoosier" kitchen cabinet for \$86 is selling the idea of convenience, for one can buy a kitchen table for \$3.25—and it will do almost the same work.

And so we fellows in the electric business may as well realize that we cannot sell sheet iron, castings and heating elements made up in the form of electric stoves; we must sell the idea of electric cooking.

The first and outstanding feature of an electric range is the price. A good range, suitable for the hard usage of daily service in a normal household, costs about seventy-five dollars.

Seventy-five dollars! Why you can get a peach of a gas stove for thirty-five and a dandy coal range for even less.

And then, the cost of operation! "It costs two or three times as much to cook with electricity as it does with other fuel"—any competitor will tell you that! And so forth. And so right there most salesmen quit—the salesmen who are trying to sell a thing of iron and heating elements.

But you are selling the idea of cooking by electricity. You will sell the idea in spite of the price of the thing.

Satisfaction First.

The history of civilization is seated in the fact that human beings are not satisfied with cheapness. If men were willing to utilize the cheapest article that would serve a given purpose, we would today be cooking over wood fires; we would be wearing denim pants; we would be walking instead of burning up 26-cent gasoline; we would be eating rice and lentils instead of squab and alligator pears.

Human beings are not satisfied with cheapness—also they are not satisfied with the old, uncomfortable, laborious, time-killing ways of doing things. People want speed, comfort, luxury. They are willing to pay for it. If we weren't, we'd be living in tepees and eating our meat raw.

I hope you will get the point in that idea, for it's the basis of success in selling electric ranges.

It is really difficult for a man who has been selling flat irons at two-ninety-eight to jump in and negotiate a stove sale at seventy-five dollars. It takes a considerable mental readjustment not to think the seventy-five is a lot of money.

Right here I'll surprise you—seventy-five is a lot

of money. But it isn't much for what the buyer gets. And that's the only way to look at the seventy-five-dollar price—look at it in relation to the value.

Is it worth seventy-five dollars to be able to cook with electricity?

Yes!

Some manufacturers of electric ranges list these advantages of electric cooking: Safety, Sanitation, Regulation, Economy, Coolness, Progressiveness. I'm not convinced that these are all the arguments, or the best arguments. It will be well to weigh your arguments well before using them.

Take safety, for example; there's no point in talking about fire hazards and the danger of explosions. The number of people you can scare into paying seventy-five dollars for an electric stove will not add much to your sales.

And similarly, about sanitation; the danger from poisonous gases which contaminate the atmosphere or food is often a bit exaggerated; and the salesman who exaggerates, forfeits his customer's confidence. As a matter of cold fact, a good gas stove, properly installed, will not contaminate the atmosphere as much as a cat sleeping on the hearth.

So let us forget the knocks against competitors and examine our own advantages.

Absence of Heat.

The woman's first objection to cooking is the heat of the kitchen. Down east, in the country, every house has what is called a summer kitchen—a lean-to located between the woodshed and the regular kitchen—where the summer canning is done. The reason is that such operations, if carried on in the regular kitchen, would super-heat the entire house. Many suburban homes have both gas and coal stoves, or combination gas-coal stoves, for the same reason.

The electric range is the coolest cooking appliance. Its coolness is inherent. The cooler it is the more efficient, for every heat unit that escapes represents loss. This argument can be played to any extreme without fear of contradiction, and especially where the housewife does her own cooking.

Most women like to feel that they can be dainty about their work. To tell a woman that she can come in from the matinee or club meeting, slip on a coverall apron, and cook a complete dinner without even becoming flushed is to arouse the first spark of desire for electric cooking.

An examination of the stove you sell will give you definite talking points along this line. The automatic feature which several stoves have; the so-called fireless cooker units; the well insulated oven, which in some cases does not have to be opened to permit the food to be watched; the surface units with their complete concentration of heat—all these emphasize the big point that electric cooking is cool.

Ease of Regulation.

The next bugaboo in cooking—as ordinarily practiced—is its uncertainty. Very many women complain that they have "bad luck" in cooking. There's a reason for this with other types of stoves, and that reason is the difficulty of regulation. The electric range has perfect regulation.

Do not make the mistake of saying that other

ranges can't be regulated, for they can. Instinct, practice and (I am convinced) the assistance of Divine Providence, will enable a skillful cook to keep even a wood stove at exactly the desired heat; the point is that the regulation of any but an electric range is uncertain.

Thus, when a woman discovers what amount of heat is required for a given operation, she can duplicate that temperature day after day invariably. If she is baking, for example, she knows after one or two experiments just how many minutes to leave on the high heat and how many minutes to leave on the low heat. If she times herself she always gets the same results. Room temperature, gas pressure, quality of anthracite, condition of the flues, flare-backs at the burner, direction of wind, humidity or luck have nothing to do with it.

Right here we may run into trouble.

"Goodness!" exclaims Mrs. Blank, "I don't know how long it takes to bake three pies. I'm sure I could never learn to run a stove like that."

This is your chance for tact.

"Madame," you say, "cooking on an electric stove may perhaps require more intelligence, but it does not require the years of practice which other methods demand. Now with your intelligence——"

And you start all over again, showing her the simplicity of the controls, the incomplex temperature gauges, the almost automatic character of the whole operation.

Then get back to this argument about certainty. Show that the danger of burnt food, of an underdone roast, of a "fallen" cake, of watery custard, of dried out meats, of parboiled potatoes—in fact all the culinary tragedies which are supposed to lead ultimately to the divorce courts—are simply impossible with an electric stove.

Here's another point: If hubby fails to show up for his meals on time, or if the dinner guests are late, the delay means ruin to food cooked upon other stoves. With an electric, the instant and perfect regulation enables the housewife to hold the cooking in process for a considerable time, and still bring it to the table in excellent condition. I sold a stove on this argument myself.

Economy.

When somebody tries to argue on the cash economy of electric cooking I have to laugh. The lower cost of electric cooking—it reminds me of the kid's essay on the subject of snakes at the North Pole: "There ain't any snakes at the North Pole." What does this word economy mean, anyway? My definition is: accomplishing something at the least cost per unit of result. And when I say cost, I don't mean money spent; I mean cost as measured in cash plus effort, plus time.

If you count the cash only, cooking electrically is expensive—except under very favorable conditions—low rates, etc. You may as well face that fact squarely. But if you count all the factors of cost—cash, time, effort and result—then electrical cooking is at least as economical as any other kind of cooking. It's the same with electric light, which is as cheap or cheaper, than candles, coal oil or gas if you take everything into consideration.

Electric cooking is economical of time. The woman who cooks on an electric range saves at least ten hours every month. Ten hours of any woman's time ought to be worth a dollar, and no woman who is able to pay for an electric range will deny it.

Electric cooking is economical of food. There is on the average ten per cent less shrinkage of foods cooked electrically than where the cooking is done by a process which hastens evaporation. Reduced to terms of the butcher and grocer's bills, this should mean at least one dollar per person per month—or say four dollars a month for a family of five.

These two items of saving amount to five dollars a month, which is more than enough to equalize the difference in the bare cost of gas as against the bare cost of electric current.

We fellows in the electric business make a mighty mistake in permitting all comparative cost arguments to centre upon the monthly bill. As well measure the food values of a meal by figuring the cubic contents of the provender, or the earning capacity of a man by his weight. The monthly bill for electricity used in cooking will be greater in many cases than the monthly bill for gas or coal or wood, but the actual cost of electric cooking is no more—probably less—than any other method.

Food Saving.

While it is possible in some instances to prove that the electric bills for cooking will be less than the bills for other fuel, this is an argument which it is seldom wise or necessary to use.

You, as a salesman—the salesman whose business it is to get the housewife's order on the dotted line, do not need any such argument. You can sell the electric cooking idea—and the stove to make that idea a reality—even when you admit to your customer that the monthly service bills are double. You can do it by insisting upon the real economies of electric cooking—the saving in food shrinkage, the time saving, the labor saving.

However, don't forget that you must translate these economies into terms of money. To tell a woman that electric cooking saves time is futile; tell her how much time, and then put a cash value on that time. To talk about the saving in food shrinkage won't convince her; tell her the amount of the shrinkage, and then put a cash value on it by checking over her last month's meat bills.

There are a lot of other economy arguments that can be developed and used. In stoves having the fireless cooker units, the thoughtful woman can use occasional cheap cuts of meat and effect maybe a couple of dollars a month extra saving. Consult your wife and butcher and find out what cuts can thus be utilized and how much the actual saving is.

Again, the automatically controlled stoves permit considerably more time saving. Consult the manufacturers and check their claims against the judgment of two or three practical housewives.

There are various ways of doubling up the items in a menu so as to cook two or more articles together, thus effecting economy of current. Before you use that argument, get a good selection of modern menus; the old-time fireless cooker salesman pretty nearly wore out the pot-roast-and-dumpling combination.

There are times when the argument about saving the cost of repainting the kitchen may be used effectively—but not often. Use plenty of tact with this argument and first be sure that the old way of cooking has caused smoke and grime. Not only do women resent the suggestion that their kitchen is dirty but there are few who would buy an electric range to save the slight cost of repainting the kitchen.

And Finally Remember This—

Don't be bluffed by price. The first cost of an electric range is not high, because you can actually prove the value.

Don't try to manufacture exaggerated arguments in favor of electric cooking. You've got too many good arguments.

Don't talk comparative costs of other fuels against electricity. Talk of the undoubted and easily proved economy of cooking by electricity.

Don't try to sell an electric stove. Sell the idea of electric cooking.—Extracts from booklet from Society for Electrical Development.

SPECIFICATION NOTES FOR DRAIN TILE.

The "Durability of Concrete Drain Tile" is the title of special bulletin No. 75 recently issued by the Michigan Agricultural College, by O. B. Winter and H. H. Musselman. The conclusions reached from their investigations are as follows. Whenever the disintegration of tile has been noted in their experiments it was found to be due to one or more of the following causes:

- (1) The use of too lean a mixture.
- (2) The use of too dry a mixture.
- (3) Improper hardening of the product after it is formed.
- (4) Placing the tile in the ground before the concrete has sufficiently hardened to afford proper resistance to the solvent action of soil water upon the cement.

The six most important factors in manufacturing concrete tile of good quality are:

- (1) A Portland cement, meeting the requirements of the standard specifications for Portland cement of the American Society for Testing Materials, as revised to date.

- (2) Clean and preferably siliceous sand, graded in size from the finer particles to those which will just pass a $\frac{1}{4}$ in. mesh screen, for all tile ten inches and less in diameter.

- (3) Proper and accurate proportioning of the cement and sand. The method of measuring materials should be one which will insure separate and uniform materials at all times.

- (4) Thorough mixing of materials, preferably by a power-operated batch mixer, and continuing for at least one minute after all materials, including water, are in the mixer.

- (5) Using a machine that accomplishes thorough packing of materials at proper consistency.

- (6) All other conditions of manufacture having been as outlined, hardening in a properly equipped and operated steam room will produce tile of the highest grade. When, however, hardening by water vapor is

not possible, tile must be kept constantly wet on the surface by sprinkling with water for not less than seven days under favorable weather conditions, and longer during cold weather.

It is stated that the practice which has been recognized as best, specifies that not more than 20 per cent of the sand shall pass a sieve having 50 meshes per linear inch and not more than 6 per cent shall pass a sieve having 100 meshes to the linear inch. A mixture of at least 1 sack of cement to 3 cubic feet of sand is recommended.

REPORT OF GLENDALE LIGHTING PLANT.

H. B. Lynch, manager public service department, city of Glendale, California, reports a profit of \$10,793.10 in the operation of the city's lighting system for the year ended June 30, 1916. The city purchases power from a private corporation and distributes it for local use. The electric light system consists of over 50 miles of pole line and an underground conduit system about one mile long through the business portion consisting mostly of nine ducts of fibre conduit. The department also owns a brick substation and warehouse and its office.

The street lighting system consists of 265 five-light ornamental standards, 107 single-light ornamental standards, 211 single-light posts, covering a distance of 17 miles, all lighted from underground cables, and 338 gooseneck lamps supplied from overhead wires.

There are now about 3100 electric meters connected to the lines of which 2780 are in the City. As there are approximately 8200 people in Glendale the system has 34 meters connected for every 100 of population. Practically every house within the limits is connected to the lines.

During the year the department purchased 1,459,318 kw.-hr. of electricity, an increase of 17 per cent in the amount used on the system.

The department operates the water as well as the lighting system, handling from the same office. All accounts are kept in accordance with the classification of the State Railroad Commission.

Rates for light are 7 cents per kw.-hr. for the first 20 kw.-hr. used per month; 5 cents for the next 14 and 3 cents thereafter, with 50 cents monthly minimum.

An examination of the detailed financial statement shows as to the electric light system:

The total electric operating revenue for twelve months was	\$ 57,590.72
From which should be deducted the following expenses:	
Total operating expenses for 12 months..\$	12,898.89
Bond and other interest	4,503.41
Depreciation of plant and equipment....	9,395.32
Total expenses for 12 months.....	\$ 46,797.62
Leaving a profit for the 12 months, after deducting operating expenses, interest and depreciation of	\$ 10,793.10
The amount invested in the electric light system is	\$130,101.66
With current assets of.....	16,848.07
Making the total investment.....	\$146,949.73
Against this is a bonded debt of.....\$	87,000.00
And current liabilities of	5,571.34
Making a total debt of	\$ 92,571.34
Leaving the surplus of the electric system from its acquisition to June 30, 1916	\$ 54,378.39
Additions and betterments to the system for the 12 months amount to.....	\$ 7,620.72
Bonded indebtedness for the 12 months..	\$ 2,500.00

SPARKS—CURRENT FACTS, FIGURES AND FANCY

The quantity of cement produced in the United States for 1915 is given by the United States Geological Survey as 85,914,907 bbl., with a value of \$73,-886,820.

* * *

Reports of the U. S. Geological Survey show that in 1915 California produced in mineral wealth a total of thirty-two million dollars as compared with twenty-five and one-half millions in 1914.

* * *

The considerable demand for antimony during the last year has stimulated the development of certain Alaskan deposits of ore of that metal, from which ore to the value of about \$74,000 was mined and shipped during 1915.

* * *

During the first half year of 1916, the gross earnings of central stations in America reached the enormous total of over two hundred million dollars, an increase of fifteen and six-tenths per cent over the best previous similar period.

* * *

One \$1000 shipment already made to India and orders on hand amounting to over \$3000 are among the new business obtained by a Chicago shoe company from its use of "Trade Opportunities" appearing in recent issues of the Commerce Reports.

* * *

One great blessing has resulted from the scarcity of raw materials due to war times. Like the scarcity of money, scarcity of raw materials leads to economy. It spurs to efficiencies hitherto thought impossible. The working out of this fundamental truth is to be observed on all sides.

* * *

The fact that the tungsten-bearing mineral—scheelite—is associated with garnet is a great help to the prospector, and all bodies of garnet rock scattered through the great granite masses of the eastern Sierra slope bordering Owens Valley are being carefully examined and panned for scheelite.

* * *

Eight men of the forty-eight hundred employed by the Pacific Gas & Electric Company, have recently been placed on the roll of honor. This high distinction commemorates forty years of active service with the company. The men are John A. Britton, R. J. Courtier, Jas. Cunningham, Jas. Kingston, George Kirk, J. Nolan, E. E. Roeing and Dan Toland.

* * *

An innocent bystander has inquired whether convicts employed in highway construction thus become highwaymen. As no serious complaint has arisen concerning past expenditures of eighteen million for such purposes in California a negative answer seems to be justified. There is every present indication that the

voters of the state will approve an appropriation for fifteen million more at the November election.

* * *

The records of the customs on the Pacific Highway at the boundary between British Columbia and Washington show that during the period from June 1 to August 15, 1916, 3768 automobiles, carrying 14,700 passengers, crossed the boundary at this point. Seventy-five per cent of these machines were American owned.

* * *

The New Zealand Government has erected during the past nine years 548 homes for workingmen. The law provides that the homes should cost no more than £300 (\$1460) each, and these are to be placed at the disposal of the workers under a lease of 50 years, with a fixed rental of 5 per cent of the capital value of the dwelling, plus insurance and taxes.

* * *

The London Omnibus Company has adopted the words "Is It Safe?" as a slogan instead of "Safety First," for the reason that if the question be mentally asked of oneself in a perilous moment, it instantly directs attention to the dangers present wherein the instinct of self-preservation will assert itself, and this is in most cases all that is necessary to induce watchfulness and care.

* * *

A million tons of nitrogen could have been obtained, by proper treatment, from the bituminous coal mined in the United States last year. At an estimated requirement of 40,000 tons of nitrogen in the form of 180,000 tons of nitric acid this would be enough for a twenty years' war. Methods of recovering coal nitrogen as ammonia and then converting it into nitric acid have been sadly neglected in this country.

* * *

Electrolytic zinc plants offer a desirable market for hydroelectric power. This week work was started on such a plant by the Mammoth Copper Company at Redding, California. At Anaconda, Mont., a similar plant has been in successful operation for some time. Amalgamated Zinc (Ltd.) of Melbourne, Australia, has contracted for 4000 h.p. from the Tasmania hydroelectric department at a \$17 per h.p. yr. with an option for 26,000 h.p. at \$9.73.

* * *

Molasses as fuel for industrial purposes is being produced in Hawaii and is to be shipped to the Pacific Coast to compete with California fuel oil. Until recently 70 per cent to 80 per cent of the exhausted molasses from the Hawaiian factories was thrown away as useless. Furnaces are now being installed which burn this molasses, the heat going to furnish steam for the factory, and the ash from the molasses, which contains 33.32 per cent potash and 4.60 per cent phosphoric acid, is used as fertilizer.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Recently there has been apparent a regrettable tendency on the part of many power companies not to encourage their engineers to attend the conventions of the technical societies. On the other hand, the commercial men are much in evidence. Such an observation is merely added evidence that this is the day of the commercial man, that the problems of selling electric current are more pressing than those of generating and transmitting it. Yet the transient importance of one should not be allowed to eclipse the permanent necessity for the other. Engineering knowledge and business ability are co-ordinate factors in the success of any technical utility. Without the engineers the salesmen would have nothing to sell.

The first reason usually assigned for the non-attendance of engineers at conventions is that engineering design, construction and operation has become so standardized that the need for an interchange of experience no longer exists. The fallacy of this argument was shown at the Seattle meeting of the American Institute of Electrical Engineers where insulator troubles and inductive interference problems were ever provocative of discussion. And when these difficulties are overcome new questions will arise, equally puzzling and likewise demanding a blending of experiences and experiments to bring about their solution. The science of electrical engineering is advancing more rapidly than any other today, and a casual standardization of fundamentals in design and construction is not the limit of development.

Another cause suggested for the absence of the engineer is that the fault resides entirely with himself. This is true in large measure. The average engineer fails to impress the management with the benefits to be derived from participation in these meetings. He is content to let others take the initiative. This inertia should be overcome and effort made to rub shoulders with others in the profession.

Furthermore, the engineer has disdained the "little" problems which most concern a central station management. He likes to deal with big generating plants and long transmission lines, neglecting the details of current utilization. As a consequence these smaller details have frequently been left to less competent men and progress has been retarded. The engineer's work would be appreciated to a far greater extent if he would aid in the solution of these minor matters.

To be specific,—all the difficulties of electric cooking and water heating have not yet been overcome. What diversity factor is to be expected from this class of consumers? What transformer and line capacity is necessary to give satisfactory service? What form of rates is best adapted to these needs? Let the engineer get down on his hands and knees to study these problems. Then he need have no complaint about lack of appreciation.

Many engineers are already awake to these facts. As others realize them the managers of the power companies will be anxious for their technical staffs to attend meetings where they may learn what others are doing to solve similar difficulties.

A technical convention is not a mere gabfest. Its true function is to instill in the minds of those who attend it a higher conception of the interests which it represents and to point out the way in which this higher conception may be translated into terms of everyday value and efficiency. So, when the next Pacific Coast convention of Electrical Engineers is held at Los Angeles in 1917 may there be a representative attendance of the men who are making possible the electrical service which the commercial men sell.

Insulator failures, once sporadic, then endemic to the Pacific Coast, and recently epidemic throughout the country, have long baffled experts. A great mass of testimony has been taken, much of it contradictory, but an entirely satisfactory diagnosis has not yet been made. A few advanced thinkers can tell why insulators fail but no one has conclusively told to stop them from failing. In this respect it is like the old question as to why girls leave home.

Perhaps the most reasonable explanation so far is that propounded as the first result of a series of tests which have been conducted at Stanford University under the direction of Professor Harris J. Ryan. These tests have been financed by a number of Pacific Coast power companies. No formal announcement has yet been made regarding the results, but from reliable sources it is learned that the porosity of porcelain is the immediate cause of its failure as an insulator. Insulators absorbing more than 0.1 per cent of their weight in water have been found defective, the pores affording a path of low resistance which is finally broken down by the repeated bombardment of high frequency currents. Experiments by W. D. Peaslee at the Oregon Agricultural College indicate that mechanical as well as electrical failures are due to this cause.

As a consequence Professor Ryan suggests that some other material may yet displace porcelain just as porcelain superseded glass. Fused quartz is proposed as such a substitute and experiments are now under way to determine its suitability. Should these prove successful a new application for electric power may thus be opened up, as the intense heat of the electric furnace is essential to melting the quartz.

Yet, in the face of these disparaging reports concerning porcelain insulators many high tension systems are maintaining satisfactory service with them. Analysis seems to show that in these systems high frequency surges have been minimized. Lightning arresters have been placed at the exact terminals of impedances and every precaution has been taken to filter out harmful transients.

So, fundamentally, those transients are the cause of insulator failures. Their elimination reduces insulator troubles to a minimum. This fact gives further incentive to the power companies to do away with

those disturbances which the telephone companies complain of as being the causes of inductive interference. High frequency transients are as inimical to successful transmission of high voltages as to successful telephony.

Consequently, conservative engineers are not yet ready to conclusively condemn porcelain insulators. Much of the mystery as to the cause of their failures has already been cleared and final reports should be awaited before taking any drastic action.

The prevalent high cost of paper has resulted in a commendatory effort to conserve the supply and prevent useless waste. Furthermore it brings to the foreground the possibility of increasing the production, especially in regions where wood pulp and hydroelectric power are available. For this reason a peculiar interest should be found in the description of the Everett paper plant published elsewhere in this issue.

A paper mill affords a most desirable form of load for a hydroelectric power company, not only on account of the power required for the production of the paper but also because the chemicals employed can be economically produced electrochemically.

Caustic soda and chlorine bleach are essential to the manufacture of paper from wood-pulp. These chemicals are produced by the electrolysis of sodium chloride and already from the basis of the most successful electrochemical industries yet established on the Pacific Coast. The possibilities of the further development of a paper manufacturing industry consequently afford a fruitful field for investigation.

The latest beneficiary from the standardization wave which is engulfing inefficiency and waste is the seller of incandescent lamps. It is now proposed to standardize central station commercial voltages, to do away with the fifty-seven different varieties of voltages, and select 110, 115 and 120 as standard.

Not only will this benefit the seller of lamps by simplifying his stock requirements and records, but it will also reduce the cost of manufacture. With the refined methods of manufacture now in use it is possible to correctly predetermine the voltage of a finished lamp. By concentrating on a limited number of voltages costs can be cut and prices ultimately can be reduced.

The great objection to such standardization comes from central stations distributing current over wide areas. No matter what the generating voltage may be, the line drop causes voltage variation at different points of consumption. Numerous substations are necessary to insure uniformity in voltage. Many progressive companies regularly make voltage surveys and inform consumers of the exact voltage at their premises. This practice is a great aid in obtaining the best lighting results and should be encouraged. Eventually, however, it seems likely that distribution lines will be shortened so that voltage standardization will be a reality.

Why Insulators Fail

Electricity in the Paper Industry

Standardizing Voltages

PERSONALS

C. C. Hillis, manager Electric Appliance Company, is making a trip East via Oregon and Washington.

Rudolph W. Van Norden, consulting electrical engineer at San Francisco, spent the past week at Visalia, Cal.

Milton Henoch, electric range specialist, Westinghouse Electric & Manufacturing Company, is at San Francisco.

T. W. Simpson, Pacific Coast manager Federal Sign System (Electric) spent the past week in Southern California.

W. G. B. Euler, superintendent of operation Great Western Power Company, was married at San Francisco last week.

C. T. Phillips, consulting engineer at San Francisco, has been elected a member of the Illuminating Engineering Society.

A. E. Morphy, assistant secretary Southern California Edison Company has returned to Los Angeles, from San Francisco.

D. S. Brown, assistant to the sales manager Westinghouse Electric & Mfg. Company, is at San Francisco from Pittsburg.

A. J. Jones, salesman with San Francisco office General Electric Company, is making an auto trip through Northern California.

Joe Beane, superintendent of the Nevada Valley Power Company, was at San Francisco from Lovelocks during the past week.

Garnett Young, manager Telephone-Electric Equipment Company, has returned to San Francisco, from an extended Eastern trip.

F. D. Fagan, manager Edison Lamp Works of General Electric Company, at San Francisco, is visiting the Eastern lamp factories.

H. E. Bittman, secretary Telephone Electric Equipment Company at San Francisco, is spending his vacation in the Feather River Canyon.

H. S. Batchelder, commercial agent Western States Gas & Electric Company, Stockton, Cal., was at San Francisco during the past week.

Elgin Stoddard, manager Chas. C. Moore & Company, has returned to San Francisco from a month's trip through Nevada, Utah, Idaho, Washington and Oregon.

George K. Weeks has resigned the presidency of the San Francisco-Oakland Terminal Railways, to become active head of the National City Company of California.

M. F. Steel, sales representative Benjamin Electric Manufacturing Company, attended the meeting of the Pacific Coast Electrical Supply Jobbers' Association at Hayden Lake, Idaho, this week.

Guy L. Bayley, consulting engineer at San Francisco, is in the Yosemite Valley making arrangements for the construction of a hydroelectric power plant for the U. S. Government.

Frank Somers, president California Association of Electrical Contractors & Dealers, is at Seattle attending the convention of the Washington Association of Electrical Contractors & Dealers.

S. M. Kennedy, general agent Southern California Edison Company, has returned to Los Angeles after completing an intimate study of commercial conditions in Washington, Oregon and Northern California.

Romaine W. Myers, consulting engineer at Oakland, Cal., is making an extended trip throughout the East, during the course of which he will attend the convention of the Illuminating Engineering Society and their course of lectures.

H. W. Alexander, director of publicity Society for Electrical Development, will be at Salt Lake City, Utah, September 24-27, in the course of an extended trip he is taking

to stimulate interest in "America's Electrical Week," December 2-9, 1916.

C. H. Huyck, salesman with the Western Electric Co., addressed a recent meeting of the Alameda County Electrical Development League on the subject of Marketing Electric Ranges. **W. R. Lyall** of the D. & W. Fuse Company also spoke on the manufacture of fuses.

Max Loewenthal, until recently electrical expert for the Dohrmann Commercial Company, addressed the members of the Los Angeles local of the Electrical Dealers' and Contractors' Association on "The Electrical Dealer's Problems" at their regular session last Friday.

H. H. Hoxie of the Electric Railway & Manufacturers Supply Company of San Francisco, is attending the meetings of the Washington Electrical Contractors' and Dealers' Association at Seattle and the Electrical Supply Jobbers at Hayden Lake, Idaho. He is expected back September 27th.

Ralph W. Pope, honorary secretary American Institute of Electrical Engineers, has been visiting the several Pacific Coast sections of the American Institute of Engineers since the close of the Seattle meeting. He was the guest of honor at luncheon at Portland, San Francisco and Los Angeles, and is now at Salt Lake City, where there is a strong probability that a section of the Institute will be formed during the next few months.

MEETING NOTICES.

California Association of Electrical Contractors and Dealers.

The quarterly meeting of the association will be held at Stockton, September 30, 1916.

San Francisco Section A. I. E. E.

The 1916-1917 season of activities of the San Francisco section will be opened Friday, September 22nd, at 8 P. M., in the rooms of the Engineers' Club, No. 57 Post street. The subject of the meeting will be "The Application of Electricity to Gasoline Driven Automobiles." **H. S. Clarrager** will present the subject of "The Entz Transmission," and **H. A. Hussey** will discuss "Electric Starting, Lighting and Ignition as Applied to the Automobile."

Washington Association of Electrical Contractors and Dealers.

The first annual convention of the association was held at Seattle, September 19-20. The opening address was given by President **V. S. McKenney**, who welcomed those present. **J. J. Agutter** spoke of the history, aims and purposes of the association. **C. C. Hillis** gave an address on "Co-operation and Education"; **P. J. Aaron** on "Acceptances"; **W. O. Fouch** on the "Oregon Association, and Results Obtained"; **C. A. Young** on "The Tacoma Ordinance and State Legislation." **W. S. Berry** gave the jobbers' idea as to what the California Association has accomplished and **F. J. Somers** talked from the contractors' standpoint. **Hugh J. Tinling** of Spokane gave his impressions of the California Association's convention. At the banquet **Albert H. Elliot** spoke on "Co-operation." On Wednesday an automobile trip was taken to the summit of the Cascade Mountains.

Oregon Association of Electrical Contractors and Dealers.

The association met at the Electrical building on Wednesday, August 30th. A code of ethics was adopted similar to that of the National Contractors' Association. The matter of approving and adopting the rules submitted for governing the Western Conference Board were adopted as submitted and it was further moved and carried that this association adopt and ratify such a board, and that the matter of selecting a delegate for said board be done by electing a member at an election to be held in the near future the date of same to be set by the executive committee. **J. W. Oberender** and **J. H. Sroufe** were appointed delegates to attend the Washington Association's annual convention to be held at Seattle, September 19-20. **A. S. Moody**, the newly appointed vice-

president and manager of the Pacific States Electric Company's Portland branch, addressed the meeting at some length. It was announced that another already built house wiring campaign was going to be held and that a committee was now working out the details.

Electrical Development & Jovian League of San Francisco.

The regular weekly meeting was held September 13th, President E. M. Cutting presiding. This being the business meeting of the month the treasurer's report was presented and accepted after which a nominating committee consisting of Messrs. D. E. Harris, H. E. Pitts, E. A. Wilcox, F. E. Boyd and H. C. Reid, was appointed to select nominees for the various offices of the league to be presented for balloting at the October business meeting. This concluding the routine business the meeting was turned over to J. C. Manchester who acted as chairman of the day and introduced Mr. Andrea Sbarboro, banker and president of the Italian-Swiss Colony of California, as speaker of the day. Mr. Sbarboro took for his subject, "Prohibition," and detailed why the pending state prohibition amendments should be voted against at the coming election. The speaker compared conditions in the European countries where the light wines and beers were as common a household article as tea or coffee in this country and presented evidence showing the almost total absence of intoxication in those countries. He believed in the strict regulation of the saloon and a distinction between liquors carrying a high percentage of alcohol and beverages with a very low or practically no percentage of alcohol.

TRADE NOTES.

The Edison Storage Battery Supply Company announces the opening of its Los Angeles office on the fourth floor of the San Fernando Building, corner Fourth and Main streets. Mr. James F. Rogan, who has been acting as local distributor of Edison storage batteries in Los Angeles will become resident manager. The Edison Storage Battery Supply Company also maintains two other offices on the Pacific Coast, one at 206 First street, San Francisco, in charge of District Manager, Mr. E. M. Cutting, and another at 65 Columbia street, Seattle, under F. C. Gibson as resident manager.

De Jongh & Cochran have opened offices for the Delco Light in the Crossley building, San Francisco. Their efforts are being concentrated on demonstrations at country fairs.

ELECTRICAL CONTRACTORS' NOTES.

The Pierce Tomlinson Electric Company installed the decorative lighting for the Home Chautauqua, now being conducted at the Armory.

The Ne Page, McKenny Company have secured contracts for installing the wiring in the new sugar refinery at Grants Pass, and the new concrete building at Seventh and Ankeny streets, being built by Percy Blythe.

The Smith McCoy Electric Company are about to commence to install a most complete and modern electric wiring system in the new mansion now being built by T. H. Wilcox, on Council Crest, Portland, this residence to cost \$100,000.

HINTS ON SELLING ELECTRIC RANGES.

"The Truth and the Proof About Electric Cooking" is the title of an attractive booklet published by the Southern California Edison Company. It contains 26 letters from satisfied consumers, together with illustrations demonstrating that electric cooking is clean, easy, appetizing, dependable, efficient, sanitary, dainty, cool, safe, controlled and progressive.

"How to Sell an Idea," is a handbook for electric range salesmen published for free distribution by the Society for Electrical Development. Its excellent arguments are based on the thought that the "idea of electric cooking" is to be sold, and not merely an electric stove. Detailed directions are given which should prove of value to any salesman.

IMPRESSIVE PLANS FOR AMERICA'S ELECTRICAL WEEK.

The presidential campaign headquarters of either great party is not a whit busier place than the headquarters of the America's Electrical Week campaign. To care for the immense amount of detail work—such as the handling of fully six million pieces of publicity matter, the society has increased its staff for the "big drive."

E. M. Hunt, formerly advertising manager of the United Profiting Sharing Corporation, a subsidiary of the United Cigar Stores, has joined the society's staff under H. W. Alexander, director of publicity. Mr. Hunt's experiences include broad training gained through participation in national and retail selling campaigns of several lines of trade. Before coming with the society he made a general study of retail trade conditions in the electrical field.

F. C. Myers is now with the society's publicity staff as trade press editor and also in direct charge of its highway lighting campaign. Mr. Myers was for ten years identified with one of the leading publishing houses as managing editor of four of its publications.

Robert A. Jones has entered the engineering department of the society as statistician. Most of his time will be occupied with handling the comprehensive electric rate files which the society has compiled to assist its members.

Its regular staff, consisting of John T. Kelly, manager of the newspaper bureau, and Hill Griffith, manager of advertising service, remain with the society in charge of their respective departments. Grace T. Hadley will handle the publicity relating to home economics.

J. M. Wakeman, general manager, has executive charge of all society work. Harry W. Alexander, director of publicity, is directly in charge of the national campaigns and all publicity and sales work.

One of the executive staff of the society will visit practically every city of considerable size in the United States during this fall with the idea of having "Electrical Nights" in the interests of America's Electrical Week and the Society. At these gatherings electrical men, advertising men, Rotary Club members and others interested will be invited to attend. The society's staff member will deliver an interesting illustrated address on the progress of the campaign and how each individual can profit. Motion pictures on electrical subjects will be shown. The America's Electrical Week Local Committees in charge of the campaign will attend to the entertainment and the jollification.

The society invites electrical men everywhere interested in the movement who are not now receiving the important literature, sales helps, etc., to send us their names, to the New York headquarters. Nearly 25,000 names are already on the mailing list. More names are being added daily.

A new committee "How To" hand book just out entitled "How to Plan Your Work," has been mailed to 1500 local committeemen, Jovian officials and N. E. L. A. Sections. It details exactly how a committee can be formed to carry on campaigns in cities of 10,000 and under—cities of 10,000 to 50,000 and 50,000 and over.

The next "How To" booklet will be entitled "More Customers—More Sales—More Profits for You." It will be ready for distribution about September 25th. Its purpose will be to detail how each individual in the industry can participate with profit.

NEW BULLETINS AND CATALOGUES.

"The History and Development of Gold Dredging in Montana" is the title of Bulletin No. 121, just issued by the U. S. Bureau of Mines. The bulletin contains sixty pages and is well illustrated.



NEWS NOTES



FINANCIAL.

SALEM, ORE.—The annual report of the Pacific Telephone & Telegraph Company for the year ending June 30, 1916, filed with the Oregon Public Service Commission, shows that the company's total revenues in Oregon were \$2,162,298.41, and that the total expenses were \$1,674,011.54. The ratio of operating expenses to operating revenues in the state was 77.42 per cent. For the entire system the company's net income was \$2,187,284.43. Dividends totaling \$1,920,000 were paid. The system's total operating revenues were \$19,477,308.84, and the total operating expenses were \$13,850,062.51.

INCORPORATIONS.

SACRAMENTO, CAL.—The Southern California Edison Company has filed amended articles of incorporation, increasing the capital stock from \$30,000,000 to \$100,000,000.

RENO, NEV.—Prominent citizens of Nevada and Utah are identified with the Nevada Telephone & Signal Company, which has been incorporated under the laws of Nevada. The president of the company is F. M. Manson of Reno; Adrian Ellis is vice-president, and J. T. Goodin, treasurer. The plans of the new company include the making of wireless telephonic experiments in various parts of the state. The company is capitalized at \$250,000, the par value of the shares being \$100 each. Work on the new line has started at Winnemucca and will be rapidly pushed to completion.

ILLUMINATION.

SUPERIOR, MONT.—H. Schoenfeld and E. J. Edwards plan the installation of a small lighting plant.

SALEM, ORE.—The Keno Power Company plans to ask Klamath Falls for a franchise for furnishing the city with light.

RIDDLE, ORE.—At a recent election bonds in the sum of \$21,000 were voted for the construction of a lighting and water system.

SANTA ROSA, CAL.—Women of the Magnolia Improvement Club have ratified the decision to install more lights in that district.

PETALUMA, CAL.—At a meeting of the citizens of the Wilson district a committee was appointed to investigate the formation of a lighting district.

IDAHO FALLS, IDAHO.—The city council has granted a new franchise to Mr. Wilcox for the construction of a gas plant. Work will begin at once.

RIVERDALE, CAL.—Sealed bids will be received up to October 3d for furnishing and maintaining all necessary apparatus for the Riverdale Lighting District.

NOVATO, CAL.—A mass meeting was held recently to discuss the matter of extending the electric light system to out-side districts, and favorable action was taken.

TULARE, CAL.—The city trustees have received a petition asking them to form an assessment district to provide for a system of electric lights in the business portion of the city.

COLUSA, CAL.—A movement is on foot here for the establishment of a municipal electric light plant. The supervisors are now inspecting other municipal lighting plants in the state.

THREE FORKS, MONT.—The engineering firm of Swearington & McCulloh of Great Falls has made detailed plans for a complete sanitary sewer and a lighting system here, according to a recent announcement.

HOQUIAM, WASH.—This place is giving consideration to the question of a municipal lighting system and has em-

ployed F. S. Burrows of Spokane as consulting engineer to look into the matter.

DOUGLAS, ARIZ.—The city council has adopted a design for ornamental lighting poles for the new city lighting system. They will be cast iron, ten ft. 11 inches high, surmounted by a 16 in. globe.

RIVERSIDE, CAL.—The common council will receive sealed bids up to September 26th for the installation of one-light electric poles, conduits and lamps on Highland Place between Brocton avenue and Suman Tract.

ANCHORAGE, ALASKA.—The cost of the electric plant and power installation to be constructed here by the Alaskan Engineering Company will approximate \$50,000 exclusive of the poles, the street lighting system, or the labor.

FRESNO, CAL.—A resolution of intention has been adopted by the trustees for the construction of an electrolier street lighting system upon each side of I street from Inyo to Los Angeles street and upon each side of Cherry avenue from Los Angeles to California street.

PHOENIX, ARIZ.—An ordinance has been adopted by the city commission ordering a special election to be held on October 23 submitting to the voters the proposition of issuing bonds in the sum of \$600,000 for the purpose of providing an electric light and gas plant to be owned and controlled by the city.

TRANSMISSION.

HOOD RIVER, ORE.—The Pacific Power & Light Company of Portland will construct a high tower here from which to extend its line across the Columbia River.

KELSO, WASH.—According to Manager B. M. Atkins of the North Coast Power Company that company plans reconstruction of transmission lines in and near Kelso, work to start October 1st.

FRESNO, CAL.—A corps of engineers under R. C. Starr, hydraulic engineer for the Pacific Light & Power Company is now in the Big Creek region directing the work, in preparation for the raising of the dams at Huntington Lake.

MT. VERNON, WASH.—It is reported that active work will be started at once on the extension of the lines of the Pacific Traction Company. The first improvement will be made five miles south of Conway and construction will cost about \$15,000.

ASTORIA, ORE.—Public service corporations have reached an agreement with the public on an ordinance requiring wires to be placed underground. The Pacific Power & Light Company will spend \$50,000 in this work and the telephone company \$20,000.

HONOLULU, T. H.—That negotiations are under way for the sale of the Island Electric Company of Maui has been made public by Charles R. Forbes, chairman of the public utility commission. It is understood the purchaser is a contractor who has handled a number of large projects on the Coast.

SANTA FE, N. M.—A water power order of designation for hydroelectric purposes has been received by the U. S. Land Office here. The order designates and sets apart lands which may be used for the development and use in the transmission of water power for hydroelectric purposes. The lands designated are along Tularosa River, Pecos River, Penasco River, Rio Grande, etc.

WOODLAND, CAL.—W. G. Decelle has succeeded Roy M. Pike as president of the Yolo Water & Power Company. Mr. Pike will be sent into the San Joaquin Valley to manage the Whitehall properties owned by White & Co. of New York, who are heavily interested in the Yolo Water & Power Com-

pany. The business office of the power company will be moved from San Francisco to Woodland.

EUGENE, ORE.—Plans for the improvements and extensions in the plants of the Oregon Power Company and the Northern Idaho & Montana Power Company were discussed at a recent conference in Eugene between H. M. Byllesby, head of H. M. Byllesby & Company, and the managers of the various plants. Definite plans for the improvements will be taken up within a month, according to Mr. Byllesby.

OROVILLE, CAL.—John A. Britton and several other officials of the Pacific Gas & Electric Company, were with Leo Vander Naillen, general manager of the Oro Electric Corporation, on a recent trip over the properties of the latter company in Butte county. The Pacific Gas & Electric Company expects an order from the railroad commission in 30 days confirming the transfer of the interests of the Oro Corporation to it.

VISALIA, CAL.—At a meeting of the directors of the Mt. Whitney Power Company G. C. Ward of Los Angeles was elected president; A. M. Kemp of Los Angeles, treasurer; Ben M. Maddox, Susman Mitchell, W. R. Spalding, C. R. Blyth and E. R. Davis directors. Fred G. Hamilton is to be superintendent of the western division and Arch Robinson of the eastern division. R. E. Smith will be in charge of the sales department. R. E. Baker is secretary and R. C. Bulger auditor.

PORTLAND, ORE.—Legal papers filed in the Federal Court from the court of the Idaho district to complete title of the Electric Investment Company to power properties in Idaho, represent a case that involved more than \$2,000,000. The sites, franchises and power plants of the Idaho-Oregon Light & Power Company, which are acquired by the Electric Investment Company through this case and its proceedings, are on the Snake River and other Idaho streams and serve a territory in Malheur and Baker counties in Oregon, besides a large territory in Idaho. The property was bought at public auction by the Electric Investment Company in Boise, on January 16, 1916.

LOS ANGELES, CAL.—Municipal ownership of the three distributing systems of the power companies in Los Angeles, these systems to be purchased on the partial-payment basis, using money now on hand to the extent of approximately \$3,500,000 as a first payment, other payments to be made from the earnings of the municipal monopoly, and the power plants along the aqueduct to be developed with earnings from the same source, the power companies to sell at wholesale their excess power during this period of construction, is the plan of campaign which is being considered here. The plan is a consolidation of the suggestions made by the Chamber of Commerce, Councilman J. S. Conwell and Commissioner Boyle Workman, together with the recommendations filed by the Municipal League. Under the plan of the merger the distributing systems of the three companies will obviate the economic waste of paralleling, permit the city to own its own power and will do away with the necessity of a bond issue. While the amount of money to be offered the companies for their systems is a matter of future consideration, the general scheme contemplates purchasing the properties of the companies at a fair valuation, on an indeterminate basis, and provides for the protection of the companies' hydroelectric and steam-plant investments through the purchase of current from the companies at wholesale rates until such time as the earnings of the combined system under municipal ownership shall have paid for the three properties and also for the development of the aqueduct power plants. The present construction of the aqueduct plants only provides for approximately 50 per cent of the power needed in Los Angeles, while it is doubtful whether or not there is enough money on hand in the city's power fund to purchase outright even the Edison system under the most favorable decision which the Railroad Commission might hand down under a rehearing.

TELEPHONE AND TELEGRAPH.

BENSON, ARIZ.—Work has begun on a new telephone line between this city and Lordsburg, N. M.

SALINAS, CAL.—The Pacific Telephone & Telegraph Company has applied for a franchise to do a general telephone and telegraph business in this city. Sealed bids will be received for such a franchise up to October 16.

SAN BERNARDINO, CAL.—Work has been started by the Pacific Telephone & Telegraph Company which will practically eliminate overhead cables and wires. Work is also being done by the company in the residential sections. The estimated cost of the improvements is about \$6,000.

SAN DIEGO, CAL.—The committee representing the first mortgage bondholders of the San Diego Home Telephone Company and the majority of bondholders and stockholders of that concern has obtained stock as well as bond control of the company's interests, and plans are being made for future development.

TRANSPORTATION.

CHICO, CAL.—The reorganization committee of the Northern Electric Railway has been here to gather data on the road and its property for its reorganization.

GRASS VALLEY, CAL.—General Manager George W. Starr of the Empire and Pennsylvania mines, has made public the plans of an electric road to connect the two mines. The road will be operated by an electric trolley system, and will be one mile long.

MARTINEZ, CAL.—That work will be started on the construction of the Martinez and Concord Interurban Electric Railway within the next few weeks was the statement of Judge Clifford McClellan, one of the promoters of the project when he was in Martinez recently. McClellan asserted that the contract for the grading is to be awarded immediately and that the grading work will be started on Escobar, Pine and Jones streets, and the Pacheco road.

IRRIGATION.

AMEDEE, CAL.—The landowners of the proposed Honey Lake Valley Irrigation district have decided for organization.

LAKEPORT, CAL.—A plan is under consideration which provides for the formation of an irrigation district in Big Valley.

TURLOCK, CAL.—At the special election in the Turlock Irrigation District the proposition to issue bonds in the sum of \$162,478 for the upkeep and repair of the canals of the district was passed.

SACRAMENTO, CAL.—Major Paul M. Norboe, assistant state engineer, has been in Glenn county, investigating the land to be opened to irrigation, being a part of the plan to reorganize the Kuhn project.

WILLOWS, CAL.—The hearing on the petition of the farmers of the Jacinto and Princeton-Codora-Glenn sections for an election on the organization of two irrigation districts has been set by the supervisors for October 2, when it is expected the report of the state engineer on the feasibility of the propositions will be filed with the board. The Princeton-Codora-Glenn district contains an area of about 18,000 acres, the Jacinto having an area of more than 20,000.

OROVILLE, CAL.—After much discussion on the advantages and disadvantages of the proposed methods of furnishing irrigation to the lands south and southwest of Oroville, the committee named by the chamber of commerce decided in favor of the organization of an irrigation district. It was decided that a definite proposition would be offered to the Western Canal Company for the purchase of water in bulk, contingent upon the organization of an irrigation district. The plan is to take the water out of the east bank of the Feather River at a point opposite the Western Canal intake.

Journal of Electricity, Power and Gas
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Wood Mats.	List.	Sell.
For 1 switch30	.25
For 2 switch50	.30
For 3 switch70	.35
For 4 switch90	.45
For 5 switch	1.10	.55
For 6 switch	1.30	.65
For 7 switch	1.50	.75
For 8 switch	1.70	.85

Receptacles.

10 Ampere Flush, Porcelain Plug, complete..	1.50
10 Ampere Flush, Indes. Plug, complete.....	1.50
Screw Plug, 10 Ampere, complete.....	1.00
D. D. Flush, 10 Ampere, complete.....	2.00
D. D. Flush, 25 Ampere, complete.....	5.00
20 Amp. Flush, with Porcelain Plug, complete.	2.00
20 Ampere Flush, Polarity, with Strain Bush- ing, complete	2.50
10 Ampere Surface Type Heater Control, com- plete	1.25
Junior, complete	2.00
Junior, Large Round Plate, complete.....	1.35
Junior, Small Round Plate, complete.....	3.00
Bulls Eye with Cand. Lamp, complete.....	4.10
Bulls Eye with Regular Lamp, complete.....	4.50
Bulls Eye with Flush Switch, complete.....	4.00
Bulls Eye with Flush Receptacle, complete..	6.00
Bulls Eye with Flush Receptacle and Flush Switch, complete	3.50
No. 465 Lamp and Indicating Switch, complete	

Outlet and Sign Receptacles for Conduit.

Keyless, Porcelain, 3 1/4 or 4-inch.....	.65
Keyless, Brass, 3 1/4 or 4-inch.....	.70
Weatherproof, Porcelain, 3 or 3 1/4-inch.....	.50
Weatherproof, Porcelain, 4-inch.....	.65
Keyless, Interchangeable	1.00
Key, Interchangeable	1.05
Pull Chain, Interchangeable.....	1.50
Pull Chain, No. 428	1.50
Mogul, 1500 Watt, Brass	2.00
Mogul, Porcelain, complete	1.50
Concealed Base Wall.....	.50
Moulding Base Wall.....	.50
Fielding Base Wall .....	.60
Polarity Wall, 20 Ampere.....	.70
Screw Ring for Signs.....	.20
Pony Sign .....	.20

The correctness of these suggested selling prices is not guar-
anteed by publisher. Suggestions for corrections are invited.Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEXNumber
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Metal Moulding and Fittings—Each.

	List.	Sell.
478 4 1/2 in. Two-Piece Rosette, Metal Cap..	.73	.85
479 4 1/2 in. Two-Piece Rosette, Metal Cap..	.75	.90
480 3 1/2 in. Two-Piece Rosette, Metal Cap..	.62	.75
481 3 1/2 in. Two-Piece Rosette, Metal cap..	.64	.80
482 4 1/2 in. Fixture, Metal Cap.....	.78	.90
483 4 1/2 in. Fixture, Metal Cap.....	.80	1.00
484 3 1/2 in. Fixture, Metal Cap.....	.64	.80
485 3 1/2 in. Fixture, Metal Cap.....	.66	.80
571 Box Cover Recep., for 4 in. Cond. Box, Metal Cap .....	.52	.70
573 Box Cover Recep., for 4 in. Cond. Box, All Porcelain .....	.45	.60
575 Box Cover Recep. for 3 in. Cond. Box, Metal Cap .....	.39	.50
577 Box Cover Recep. for 3 in. Cond. Box, All Porcelain .....	.34	.45
579 Box Cover Cond Rosette, for 4 in. Cond. Box, Metal Cap .....	.56	.70
581 Box Cover Cord Rosette for 3 in. Cond. Box, Metal Cap.....	.45	.60
583 Box Cover Fixture Rosette for 3 in. Cond. Box, Metal Cap.....	.60	.75
585 Box Cover Fixture Rosette for 4 in. Cond. Box, Metal Cap.....	.48	.60
2250 Female Stud, 1/4 in.—Per C.....	5.50	7.00
2251 Male Stud, 3/8 in.—Per C.....	5.00	7.00
2252 Male Stud, 1/2 in.—Per C.....	6.50	7.00
2253 Female Stud, 3/8 in.—Per C.....	7.00	8.00

Moulding Wood.

Per 1000.

2 Wire, Plain	30.00
2 Wire, Painted	40.00
3 Wire, Plain	45.00
3 Wire, Painted	60.00

Wood Moulding Fittings.

2 Wire, Single Branch.....	.30
3 Wire, Single Branch.....	.45
3 to 2 Wire, Single Branch.....	.40
3 to 2 Wire, Double Branch.....	.60
2 Wire, Double Branch .....	.45
2 Wire, Angle .....	.50
3 Wire, Angle .....	.60
2 Wire Corner .....	.30
2 Wire Crossing, 2W Crossover.....	.15
3 Wire Crossing, 3W Crossover.....	.20
2 Wire Crossing, 2W Crossover.....	.20
3 Wire Crossing, 2W Crossover.....	.20
2 Wire Connections25
3 Wire Connections35
Single Crossover06
Wood Rosettes10

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, SEPTEMBER 30, 1916

PER COPY, 25 CENTS

THE HALSEY AND WISE POWER PLANTS.

BY ROBERT SIBLEY.

CONVEYANCE OF WATER IN OPEN CHANNELS ON THE FARM.

BY S. T. HARDING.

FLUCTUATION IN WATER TABLE AND EQUIVA- LENT NET DEPTH OF WATER.

BY B. A. ETCHEVERRY.

THE COST OF PROGRESS.

BY LESLIE CRAVEN.

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Edison Storage Battery Co.

Boller Feed Water Treatment

Dearborn Chemical Co.

Conduit Products

Sprague Electric Co.

Electrical Slate

Davis Slate & Mfg. Co.

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Pacific States Electric Co.
Electric Ry. & Mfrs. Supply Co.

Feeder Regulators

Westinghouse Elec. & Mfg Co.

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Hemingray Glass Co.
Pierson, Roeding & Co.
Locke Insulator Mfg. Co.

Ironers (Electrical)

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Century Electric Co.
Pacific States Electric Co.

Piplog

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Power Plants

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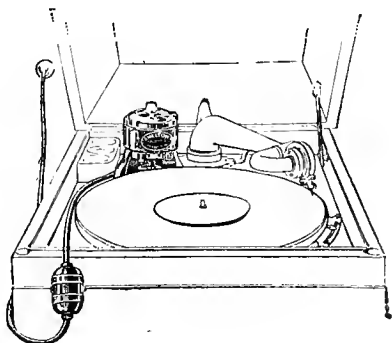
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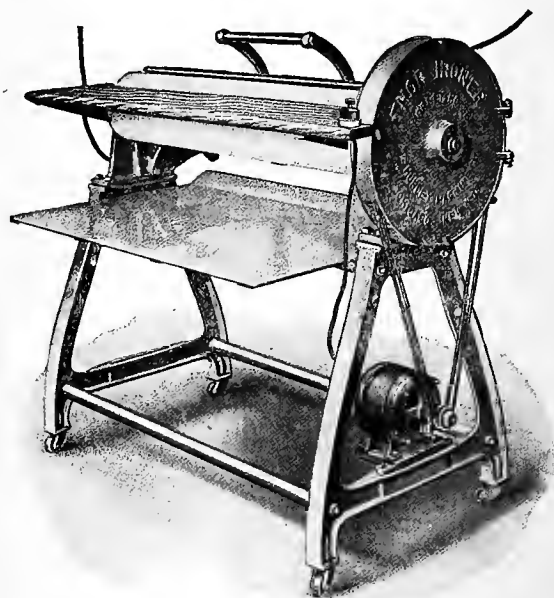
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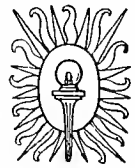
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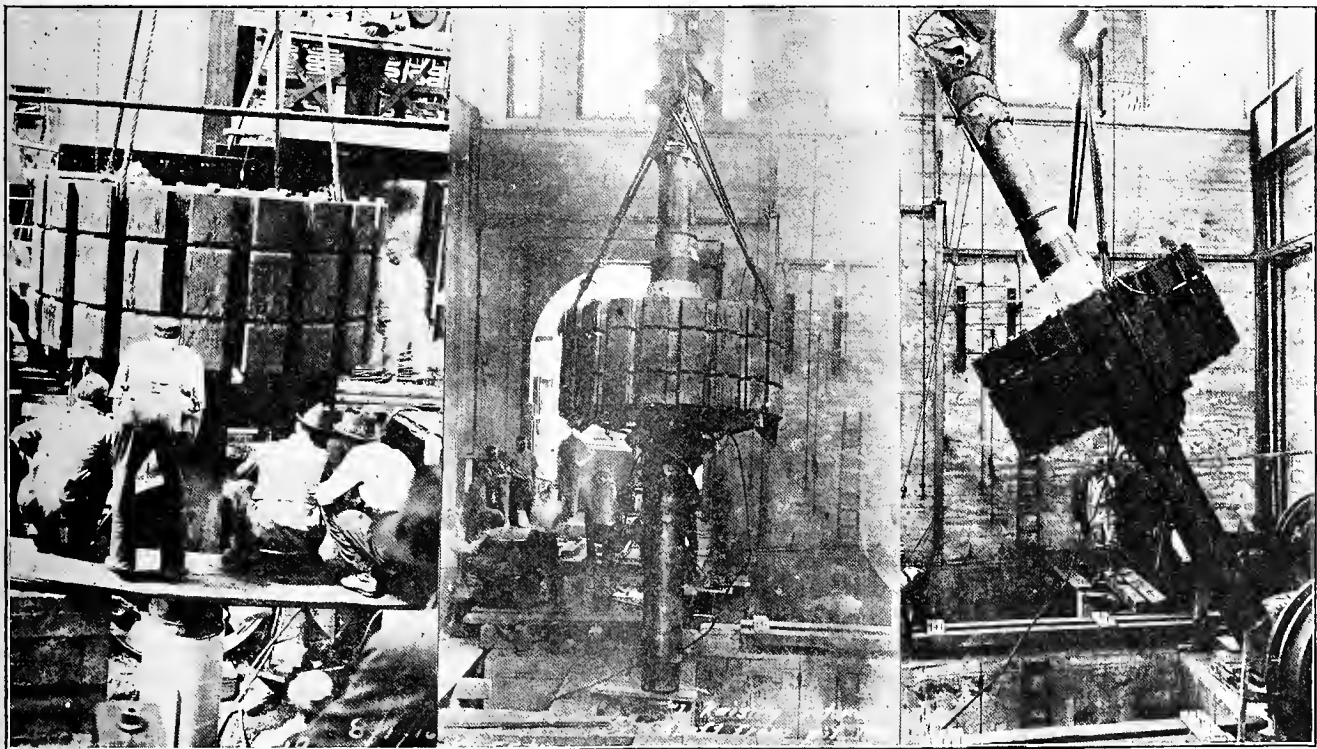
THE HALSEY AND WISE POWER PLANTS

BY ROBERT SIBLEY.

In the heart of the snow-capped Sierras about one hundred sixty miles northeast of San Francisco and twenty-three miles below Summit, California, is an artificial reservoir known as Lake Spaulding. This reservoir conserves the flood waters of a vast region and will act as a main artery in feeding some six or seven hydroelectric power plants when the Lake

power plants, one is now in operation, being that of the Drum installation completed just in time to assist in furnishing additional power for the wonderful electrical effects of the Panama-Pacific International Exposition at San Francisco in 1915.

Within the next two months, two additional power plants will be put into service. These are shown as



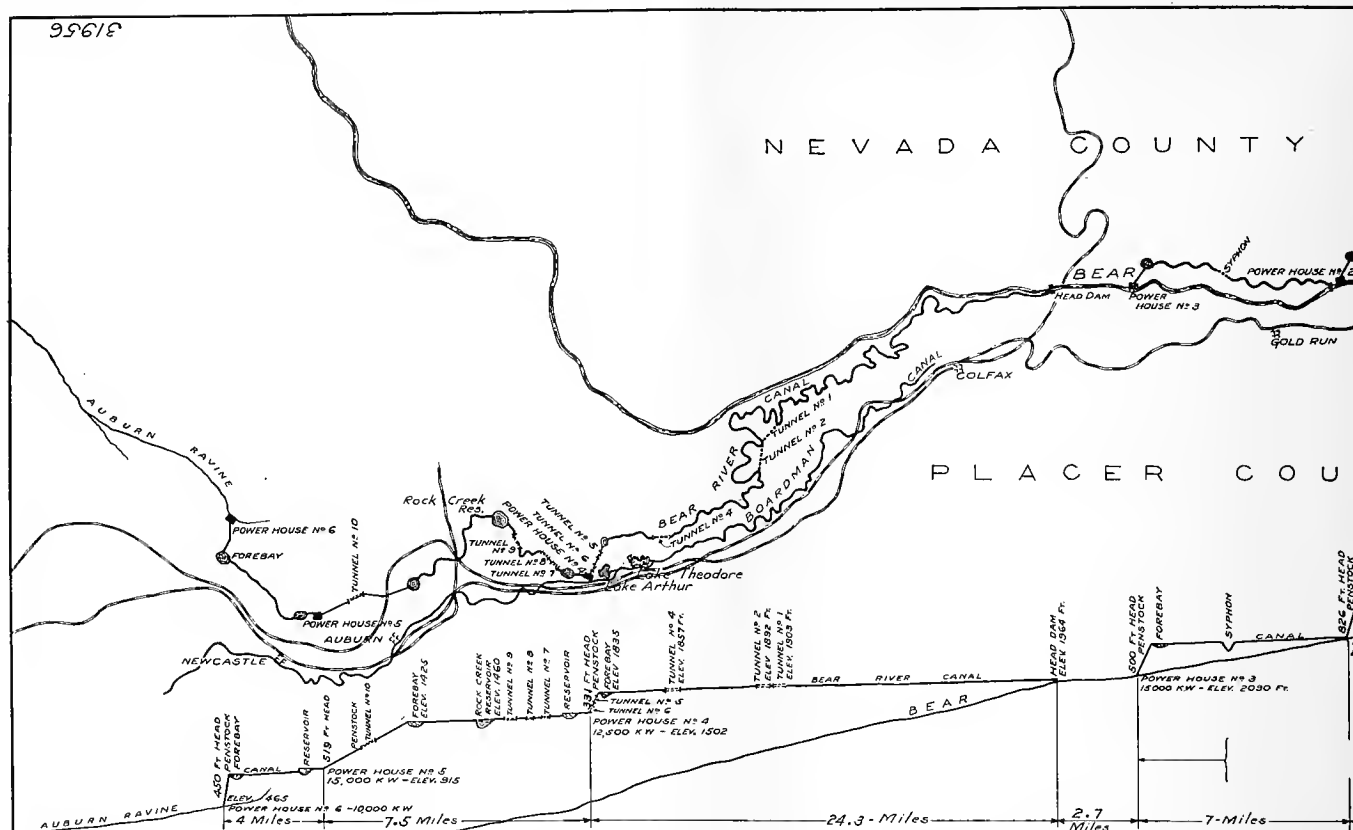
The Shrinking of a Fifty-Five Ton Rotor and Shafting at the Halsey Plant.

(In the first view the huge rotor is being lowered upon the shafting, in the second view the shrinking has been accomplished, while in the third view the rotor and shafting are being lowered into their horizontal position for permanent installation. Note how small the attendant looks in this last picture.)

Spaulding Development is completed. After the water has spent itself in thus driving the wheels of industry, it is to be finally used in irrigating the fertile farms in the Sacramento Valley.

The Spaulding dam, when finally completed will rise 305 ft. above the gorge upon which it rests and will thus create the deepest artificially impounded waters in the world. Of the six or seven proposed

Nos. 4 and 5 on the map accompanying this article, and are to be known as the Halsey and Wise Power Plants, respectively. The remaining plants will be installed as rapidly as the growing service of the company will demand their use, which, due to the increasing cost of fuel oil and consequent slackening in development of steam power, will not be far in the future. It is the purpose of this article to describe the



General Map of the

features of construction encountered in the installation of the Halsey and Wise power plants, leaving a description of the canals and penstocks of these plants for the subject matter of a later article.

The Halsey Power Plant.

By reference to the map it may be seen that water from the Bear River Canal is conveyed through tunnel and penstock to Power House No. 4 which is to be known as the Halsey Power Plant.

The generator which is of the Westinghouse design has a rated capacity of 12,500 k.v.a. It is directly connected with two Allis-Chalmers water wheel units, each of 9000 h.p. capacity. Electrical energy is generated at 6600 volts, three-phase, sixty cycles, at a rotative speed of 360 revolutions per minute. The governor is of the standard Allis-Chalmers design. The generator is separately excited by means of a 100 kw., d.c. Crocker-Wheeler dynamo which is directly connected to a 150 h.p. Pelton water wheel unit.

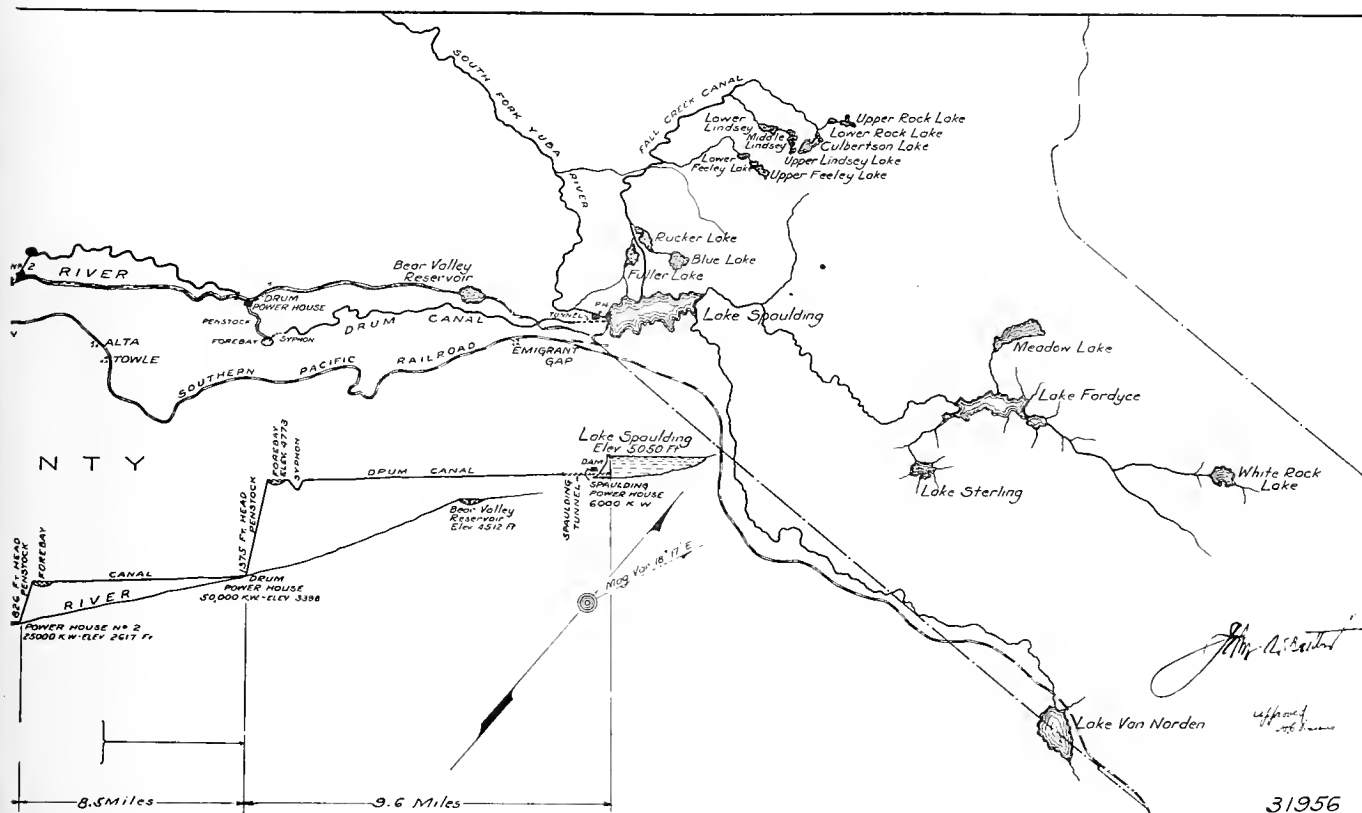
In the installation of the generating unit at this plant the shrinking of the rotor to its shafting proved to be an interesting problem in which the fifty-ton crane installed in the frame-work above proved most useful. The interior bore of the rotor was found to be fifteen thousandths of an inch too small and the shafting ten thousandths of an inch too large at the temperatures available at the power plant. Since the combined weight of shaft and rotor is fifty-five tons without pole pieces and with them becomes some eighty-four tons, the problem was well out of the ordinary for solution. A scheme was devised wherein the shaft was hoisted into an upright position and ice was packed in the hollow portion of the shafting so that the resulting contraction brought its diameter

below normal, while the rotor was immersed in boiling water, thus expanding the rotor diameter above normal. At this point in temperature readjustment the rotor was lowered upon the shafting and today rotor and shaft are as a consequence shrunk together in such a manner that no lost motion between rotor and shafting may ever be anticipated throughout the life of the machinery involved.

A distinct feature of this plant is the location of the three large transformers of 4250 kw. capacity which are of the Allis-Chalmers design. The transformers are situated in separate concrete partitions in the main generating room at its western end. Unlike the Drum installation, they are placed in concrete pits so that about half their total depth is below the level of the power house floor, thus reducing the height of housing required and at the same time allowing ample space for hoisting the transformer parts when occasion requires. The transformer core weighs about twenty-three tons, the casing ten tons, and when equipped for service with forty-four hundred gallons of oil they will each weigh about fifty tons. They are nearly nineteen feet high and eleven feet in diameter.

The method employed in drying out these transformers is interesting. The steel casings for the transformer top is first bolted down so as to make an air tight compartment within. The air is then pumped out until about a twenty-two inch vacuum is obtained. Low pressure steam is then applied through the cooling coils, thus giving a quick and ready means of heat application for the drying of the transformer coils.

The transformers are tied in directly with the one hundred and ten mile Drum-Cordelia transmission



Spaulding Development.

system by the delta connection, so that 100,000 volts are thus delivered. On the other hand a Y connection by grounding the neutral is performed so that 60,000 volts may be delivered to a new steel transmission line that is being erected to connect the Halsey and Wise plants directly with the 60,000 volt service line now used in and about Stockton, California, some sixty-seven miles to the southwest. This new 60,000 volt transmission line is of the steel tower design with suspension insulators. Each insulator has seven units of ten-inch diameter.

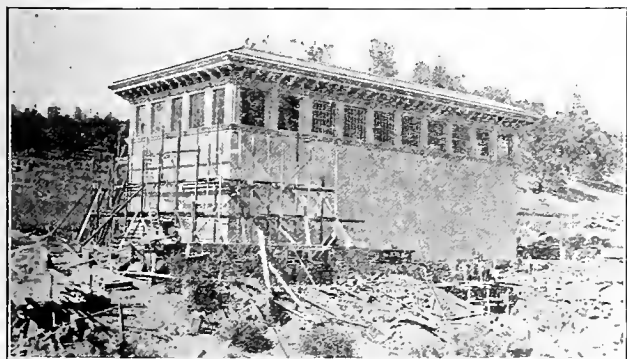
The Wise Power Plant.

The water from the Halsey plant passes out into a regulating pond constructed immediately below the power house. From this regulating pond it is conveyed through canals and tunnels and storage dams, finally dropping through the penstock a vertical distance of 519 ft. into the Wise Power Plant.

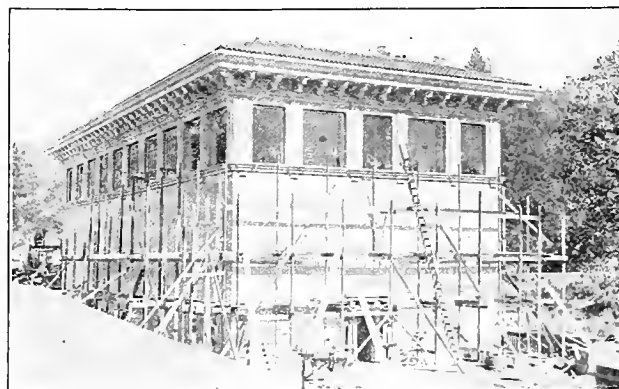
The generator and exciter units are identical with the Halsey installation. In the water wheel unit, how-

ever, a single installation of 20,000 h.p. capacity is made instead of two separate units. This water wheel unit is of the Pelton-Doble design and is the one exhibited by that company at the Panama-Pacific International Exposition. It is said to be the largest single discharge turbine in the world.

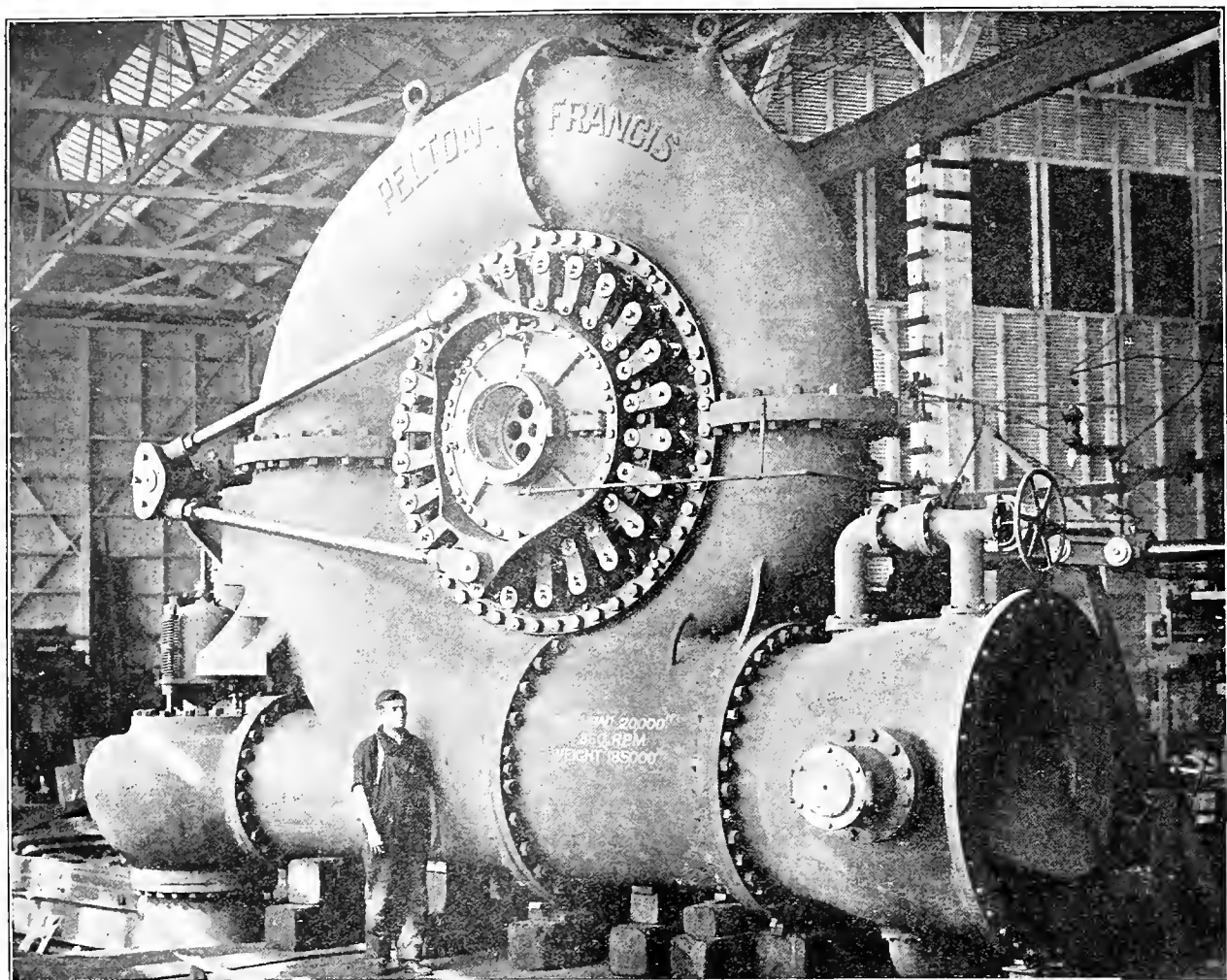
The generator speed being fixed at 360 r.p.m. and the available head at 510 ft., a single nozzle tangential wheel, having a specific speed of 5, would develop 100 h.p. To develop 20,000 h.p., the predetermined size of unit, would require 20 jets, a combination impractical under operating conditions. On the other hand, a turbine with a specific speed of 20, would develop 18,000 h.p. at 360 r.p.m. under a head of 500 ft. These limitations indicated a reaction turbine as the most suitable type of water wheel. The generator having been built for drive by a Pelton-Doble wheel, the shaft overhang was small. In the interests of



The Exterior of the Wise Power House.



The Halsey Power House.



The Twenty Thousand Horsepower Hydraulic Unit at the Wise Plant, the Largest Single Discharge Unit in the World.

economy, it was desirable to use the shaft of original design. To do this required a single discharge unit.

Because of the impact of the water column in a pipe line of the length found in this development, special care must be taken to avoid destructive surges. In the unit under consideration this is accomplished by means of a Pelton-Doble cataract type water economizing relief valve. This valve is controlled by the main rock shaft, directly actuated by the governor. With a sudden load rejection the relief valve is opened, and then is gradually closed, an adjustable time limit device maintaining the rate of closure to prevent a dangerous rise of pressure. On minor load rejections of a magnitude insufficient to set up dangerous surge pressures, the relief valve does not open.

Exterior and Interior of Power Houses.

In the housing of the electrical and hydraulic equipment, the exterior finish of the power houses for the Halsey and Wise plants is of high order. The compactness of arrangement, yet the freedom and accessibility throughout, impresses the visitor to these power plants. The tile roofing and architectural embellishments from without are simple in construction, yet this very simplicity is so subtly brought out that the tourist in an automobile on the Lincoln Highway which passes within a stone's throw of these power houses gains unconsciously a certain sense of respect and admiration for the service of this company which

thus displays such simplicity and straight forwardness in design of its mountain hydroelectric plants.

The installation of the Spaulding Lake development is under the general supervision of John A. Britton, vice-president and general manager of the company. P. M. Downing has active charge of all work and serves as chief engineer with F. G. Baum as consulting engineer. J. P. Jollyman is in charge of electrical construction and H. C. Vensano is civil and hydraulic engineer. All construction work upon the project is in charge of James Martin. The Spaulding Lake addition is directly in charge of Otto W. Peterson. The building of the Rock Creek dam and other concrete work for the Halsey and Wise power plants is directly in charge of H. Van Erkeler, the laying of the penstock pipes is in charge of Fred Worley, while electrical construction upon the ground is in charge of Wm. C. J. Finely.

In conclusion, as one bears in mind the Spaulding Lake development as a whole and then recalls in mind the Halsey and Wise developments in particular, he cannot help but be convinced that once again the Pacific Gas & Electric Company is by these two concrete examples guaranteeing to the public throughout all posterity an even still better continuity of service and a safer investment due to such evident high class workmanship and utilization of the power rights held by this company in the high Sierras of California.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING



Earth Ditch, Grass Grown and Irregular.

Earth Ditch Built with V-Crowder.

Earth Ditch on Steep Grade.

CONVEYANCE OF WATER IN OPEN CHANNELS ON THE FARM.

The conveyance of water from the point at which the supply is received, whether a pumping plant or a canal turnout, to the different fields and parts of each field on the farm, is an important part of the irrigation system. For the conveyance of large irrigation heads, such as are typical of practice in the irrigation of alfalfa under gravity systems, earth canals are used almost exclusively. For the smaller heads, generally less than 3 second feet, which are more typical of pumping plant practice, there is a greater choice of methods of conveyance. The three types of conveyance channels in general use are (1) ordinary earth ditches, (2) lined canals or flumes either of concrete, wood or steel, and (3) pipes usually of concrete. The latter class were discussed in the issue of September 16, 1916. Earth ditches are used for most farms. In certain localities or for certain crops the second and third classes are used quite largely. There is no one class of conveyance channel which is best for all conditions. The type to use in any particular case depends on the cost of water, the value of the crop, the size of the stream to be handled and the topography of the land.

Of the types of open channels, earth ditches are the most important. They are generally used for all methods of distribution except for furrow irrigation and even for this method, ditches will usually be found outside of certain portions of California. Lining of ditches to save seepage losses is now being employed on many canal systems. Such linings have not as yet been extended to farm ditches for the saving of seepage. Farm ditches are usually in use only part of the time and the total saving would be less in proportion to the cost. Concrete lined canals or flumes are used in some cases to permit a closer control and more uniform division of the water. For small heads such use is being replaced by concrete pipe. Wooden flumes may be used to cross depressions on the farm. Steel flumes are suited to such use but up to present they have not been used to as great an extent on the farm as on the canal systems.

Earth ditches.—The design of canal sections of large capacity is becoming relatively well standardized. For small laterals or farm ditches carrying five second feet or less the principles of design developed for larger canals cannot be as directly applied, as the conditions of use are more variable and the selection of empirical constants more uncertain.

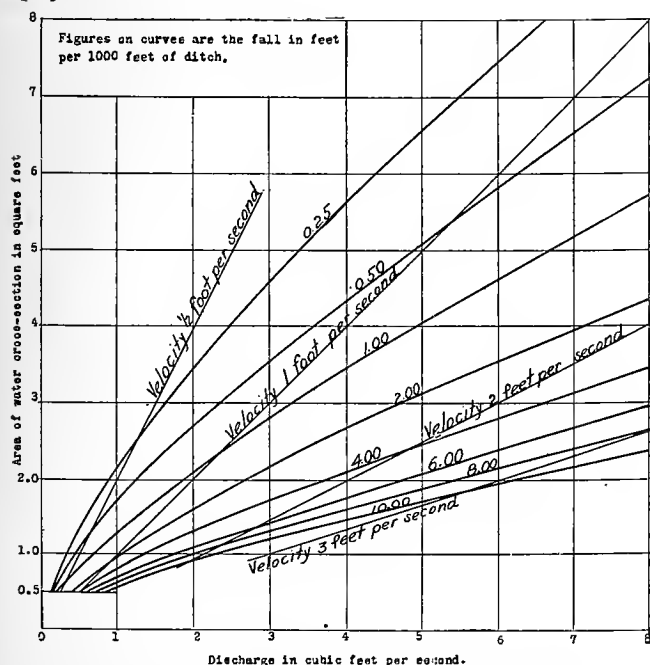


Fig 1. Carrying Capacity of Small Earth Ditches in Average Condition.

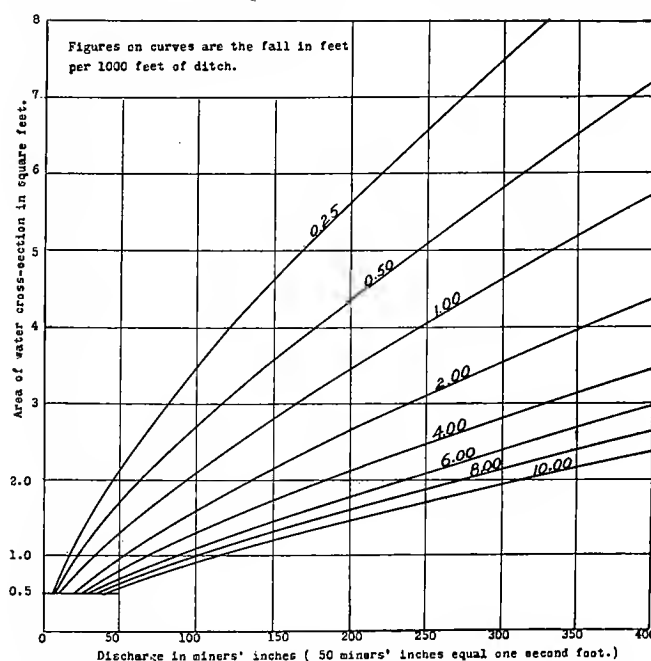


Fig. 2. Carrying Capacity of Small Earth Ditches in Average Condition Expressed in Miner's Inches.

The grass or weeds which may grow in the canal during periods between use have a greater proportional effect than similar growths on large canals so that the capacity of a farm ditch depends more largely on its condition than on its actual size. There is a certain minimum of size below which it does not pay to go. It is also usually better to build small ditches with excess capacity so that cleaning may not be as frequently required during the rush of summer work.

Various tables have been published showing the carrying capacities of small earth ditches of different sizes and grades. These are usually computed by the same formula used for large canals, the friction factor being selected for canals in average condition, for Kutter's formula the usual value of "n" being 0.025. From such tables, the curves given in Figs. 1, 2 and 3 have been plotted. In using these curves it should be remembered that some margin in capacity should be provided if unfavorable conditions are liable to occur.

Discharges are expressed in terms of second feet, miners' inches and gallons per minute, as all of these units are used in different irrigated sections. The miners' inches have the value of 1-50 of a second foot or 9 gallons per minute. This is the value employed in Southern California, Idaho and Nevada. The statutory value in California, Arizona and Oregon is 1-40 of a second foot.

In order to use these tables the grade of the canal and the area of the water cross-section are needed. The grades are expressed in terms of the fall in feet per 1000 ft. A grade of 1 foot in 1000 ft. corresponds to a little less than 3-16 in. per rod. This equivalent may be of use as many farmers are accustomed to figure grades in inches per rod. The velocity for a given ditch increases as the square root of the grade. While the carrying capacity of a canal depends to some extent on the form of the cross-section as well as the area, for small ditches the effect of the shape can be neglected as the form of cross section varies less than for large canals.

In Fig. 1, lines are drawn indicating the average velocities. These may be of use in determining the maximum slope if washing is liable to occur. It will be noticed, however, that for such small capacities the velocities secured, even with relatively heavy grades, are quite low. Most soils are able to stand a velocity of two feet per second when the original soil is exposed. The soil loosened by plowing in construction or in cleansing may erode at lower velocities but the amount of this cutting will usually not be large.

Having the desired capacity and the available grade the required area of water cross-section can be taken from the curves. Having the water area, the shape and dimensions of the ditch can be determined. For discharges of less than about two second feet the size of the ditch is more often determined by considerations of minimum size and the height of delivery.

In order to deliver water from a ditch into a check, the surface of the water in the ditch must be somewhat above the elevation of the land at the upper end of the check. For heads of 2 second feet or less, the water in the ditch should be at least 4 inches above the land, for larger heads a height of 6 inches is needed unless excessively wide boxes are used.

Small ditches are generally made by using the excavated material for the banks. Farm ditch banks should extend at least 3 inches above the high water mark where water is held 4 inches above the adjacent ground and 4 inches, where it is held 6 inches above. This gives a height of bank of 7 to 10 inches. Where water for a number of checks is controlled from one check gate in the ditch, the height of the banks just above the check gate may need to be higher.

On some fields less freeboard is used; however, the liability of delays and loss of water due to breaks is generally sufficient to overcome any saving. Where water is carried in a ditch most of the time, as in the supply ditches, a greater freeboard is desirable. Ditches

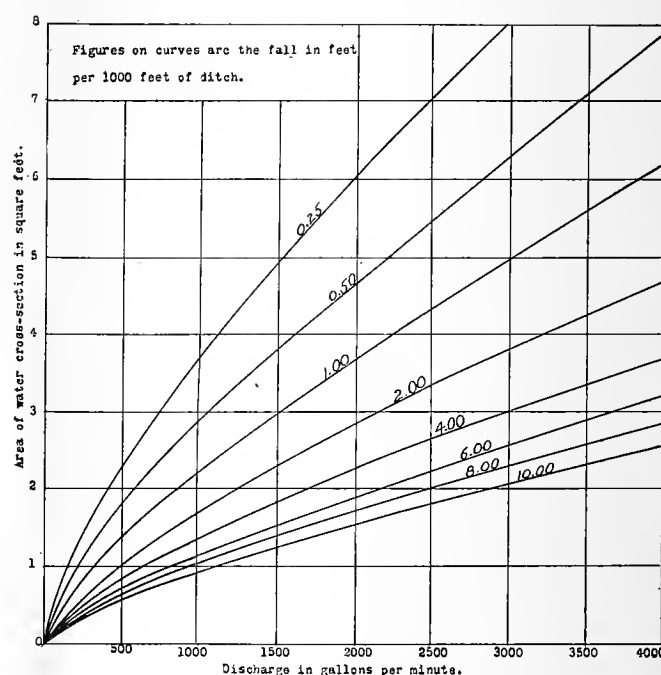


Fig. 3. Carrying Capacity of Small Earth Ditches in Average Condition Expressed in Gallons per Minute.

from which delivery to the land is not made can be built more largely in excavation.

For small field ditches carrying less than 5 second feet the top width of the banks can be made quite small; Sufficient width for walking, 8 to 10 inches, is enough. The side slopes of the banks can also be made relatively steep, as they are usually more or less sodded. For larger ditches more liberal banks are advisable. A ditch bank is only as strong as its weakest point and uniform work is preferable to irregular banks, although the average size may be greater.

The minimum ditch bank given, 7 inches high, 8 inches top width and one to one slopes contains $\frac{3}{4}$ of a cubic foot per lineal foot of bank or $1\frac{1}{2}$ ft. per foot of ditch. Material for these banks would be secured from a ditch with a bottom width of 18 inches and a depth of cut of 8 inches. This represents about the smallest ditch that should ordinarily be built. With a grade of 1 foot per 1000 ft. such a ditch will carry about 2.5 second feet, if in good condition.

Earth ditches require more space than other forms of channel. The minimum size given above will require a width of 6.5 ft. between outer toes of banks. A ditch carrying 8 to 10 second feet will use a width of about 11 ft. Small ditches are usually made by plowing from 2 to 4 furrows and using a V-shaped drag

to crowd the earth into the banks. If the ditch is to be permanent it is usual to go over it and finish the section by hand. From two to four horses may be used on the drag or crowder. Ditch plows which form the ditch and banks at one operation are also used, the power required being greater. Such methods do not form compact banks and the ditches should be made in advance of their use in order to allow the banks to settle. Larger ditches are made with a slip scraper or a Fresno. Slip scrapers can be used along the line of the ditch if the bottom width is 30 inches or over. This enables the section to be finished more uniformly. The section is first roughed out by cross bucking or driving back and forth across the ditch loading in each direction.

The amount of material to be moved in ditches of this size is so small that the quantities can not be expressed conveniently in terms of cubic yards. The lineal feet of ditch is a more convenient term.

Where the earth is in good condition for plowing, two men and four horses may make a mile of small plowed and crowded ditch in a day. Ditches carrying 5 to 10 second feet can be built with scrapers for from 2 to 4 cents per lineal feet. This is much less than any other form of channel of equal capacity and accounts for the wide use of earth ditches even in very porous soils.

The annual cost of maintenance of earth ditches may be nearly equal to the first cost if frequent cleaning and weed cutting are necessary. If such cleaning is required at times when other farm operations require all the labor available it is liable to be neglected, resulting in wasting of water over the banks or the use of smaller irrigation heads. Well built large ditches requiring a minimum of attention during the season have a very material advantage in this regard.

RELATION BETWEEN FLUCTUATION IN WATER TABLE AND EQUIVALENT NET DEPTH OF WATER.

BY B. A. ETCHVERRY.

In estimating the volume of drainage water to be removed by a proposed drainage system, one of the best and most generally used methods is to obtain by means of test wells the rate of rise in the water table during the period of maximum rate of rise and with this data and the properties of the soil for water holding capacity determine the equivalent net depth of water represented by this rate of rise.

For instance assume the following conditions and properties of a clay loam soil. First, at the beginning of the period of rise the water table to be 10 ft. below the surface and at the end of the period 7 ft. Second, the maximum water holding capacity of the soil against gravity near the surface, where the soil is essentially free from the effect of capillary action drawing the water up from the water table is 16 per cent of the soil volume (this includes hygroscopic and capillary moisture). Third the total pore space of the soil is 34 per cent of the soil volume. Then the soil moisture will be distributed in the soil depth somewhat as shown in Fig. 1. Curve 1 represents the moisture distribution before the rise of the water table; curve 2 after the rise has taken place. In both curves the pores of the soil

immediately above the water table are entirely filled with water, from this point up towards the surface of the soil the percentage of soil moisture decreases, to a point where the action of capillarity in drawing water from the water table ceases. Above this point the curve is essentially straight, the moisture content being practically the same up to the surface of the soil. In Fig. 1 it has been assumed that the soil moisture is slightly less due to the effect of evaporation.

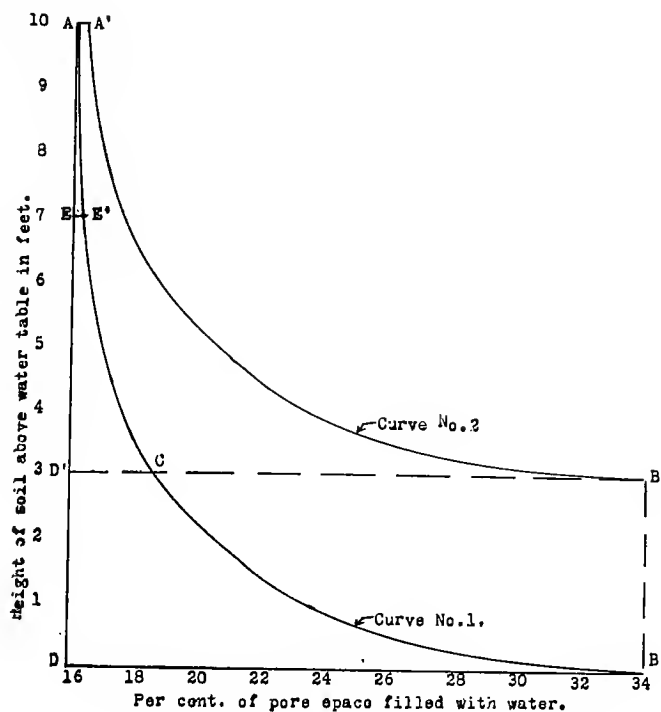


Fig. 1. Increase in Soil Moisture with Rise of Water Table.

The method generally used to obtain the net equivalent depth of water is as follows:

Total rise in water table, 3 ft.

Pore space occupied by hygroscopic and capillary water (when not influenced by the water table) obtained, for instance, by measurement of the soil moisture in the top foot of soil 16 per cent.

Total pore space, 34 per cent.

Pore space occupied by drainage of gravity water, 34 less 16 or 18 per cent.

Total net depth of excess water represented by rise of 3 ft., 18 per cent of 3 ft. or 6.48 inches.

If this rise occurs in one month the daily depth of drainage water to be provided for in the system is then 6.48 divided by 30 or 0.216 inches.

By this method the moisture added to the soil is that represented by the rectangle D'BBD' (Fig. 1). The actual amount of soil moisture added is that included in the tapering area A'B'DAA' included between the two curves. A study of the diagram gives the following relations:

$$A'B'DAA' = CB'BC + A'B'DAA' - ACD'A.$$

$$D'BBD' = CB'BC + ACBDA - ACD'A.$$

equal to ACBDA, the difference being equal to AEE'A which is negligible, DE being equal to D'A. This can readily be seen if it is remembered that the curvature of curve 1 and of curve 2 is similar and that the base and altitude are the same for A'B'DAA' and for E'BDEE'.

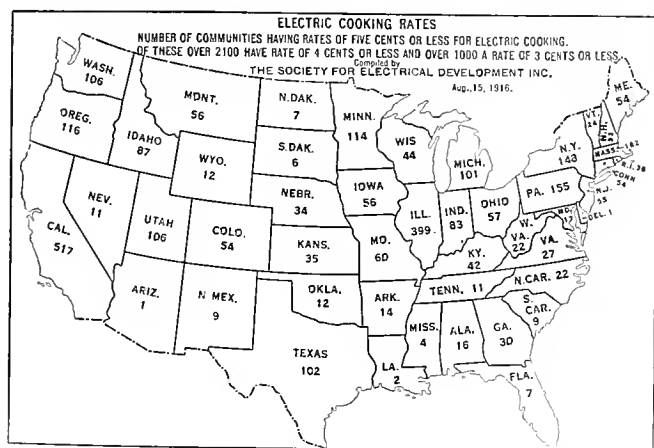
This demonstrates that the usual method is essentially correct.

If however, the rise of the water table is sufficient so that the moisture in the surface soil is materially increased, the area similar to AEE'A becomes greater and the difference in the quantities obtained by the two methods becomes larger. Where the moisture in the surface foot is increased by the rise of the water table the quantity of water added to the soil is less in proportion to the rise.

The curves in Fig. 1 are suggestive of the probable form rather than representative of the numerical conditions in any case. The height through which water will rise by capillarity varies with the type of soil, being greatest in the heavy soils. When the depth of the water table in such soils is less than the limit of capillary action, the addition of a given quantity of water will raise the water table a greater distance due to the greater moisture content of the upper soil and the smaller amount of water needed to saturate it. Where the moisture in the surface foot exceeds the field capacity with free drainage, the methods previously illustrated will give too large quantities to be removed by the drainage.

HEATING RATES.

The rapidly increasing demand for electric ranges, with their convenience, reliability and cleanliness, has led to an investigation of rates for electric current by the Society for Electrical Development. This load for central stations is extremely desirable, because the bulk of it comes on the off-peak, and thus assists in straightening the load curve. The accompanying map



shows the number of communities having special cooking rates and the location of these communities by states.

In analyzing the compilation of rates for electric cooking in the United States the interesting fact develops that of some 3000 communities listed where rates are 5c or lower, 1884 are located in the eastern half of the country, and 1250 in the western half, or, taking the Mississippi as the dividing line, 1638 are east of the Mississippi as against 1506 west of the Mississippi River.

Contrary to the general impression that low rates for cooking are largely confined to the Western States, it will be seen that central stations in the East have realized the advantages of this load and are offering special rates as an aid in building it.

THE COST OF PROGRESS.

BY LESLIE CRAVEN.

(This lucid explanation of functional depreciation constitutes the first part of a paper on "Adequate Protection Against the Risks of Obsolescence and Inadequacy" presented at the Seattle convention of the Northwest Electric Light & Power Association, Sept. 8, 1916. The concluding portion of the paper, wherein a remedy is suggested, will be published next week.—The Editor.)

The question of obsolescence, and of the proper protection of investments in electric light, power, and traction equipment against the losses caused by obsolescence, is one of the most intangible and perplexing questions with which the investors in such property and those engaged in managing and operating it, must deal. The difficulties of the question have been great throughout the history of electrical industry and have been magnified by the present day system of the regulation of such investments and their earnings upon the basis of physical valuation. Because of the fact that the problem is peculiar to each plant, it has not been found practicable in this discussion to treat the question otherwise than in a general manner. Brief consideration of the questions involved will explain and justify this course. In a time when the practical mind seeks definite information upon all questions, it is the regret of the author that such treatment is necessary.

We may begin with this fundamental proposition; a utility engaged in a public service undertaking which involves the employment of property the life of which is limited in duration, is entitled to a fair return on the investment and in addition, to collect such sums as will be sufficient to replace the property at the end of its life. One right is as certain and necessary as the other. One secures a fair compensation for the use of the property and the other insures the investor against the dissipation of the property while in that use. This is an elementary proposition universally recognized by courts and commissions. An interesting discussion of the principle is found in the case of Fuhrmann vs. Cataract Power & Conduit Company, decided by the New York Commission of the Second District and reported in Vol. 3, page 657, of its decisions.

The duty of the maintenance of the investment is a duty which is owed both to the security and stockholders and to the public. The duty is imposed by the public utility laws of many of the states. The United States Supreme Court has recognized the duty in emphatic language in the case of Knoxville vs. Knoxville Water Co., 29 Sup. Ct. 152, where the court said:

"A water plant, with all its additions, begins to depreciate in value from the moment of its use. Before coming to the question of profit at all the company is entitled to earn a sufficient sum annually to provide not only for current repairs, but for making good the depreciation and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste, without making provision out of earnings for its replacement. It is entitled to see that from earnings the value of the property invested is kept unimpaired, so that, at the end of any given term of years, the original investment remains as it was at the beginning. It is not only the right of the company to make

such a provision, but it is its duty to its bond and stockholders, and, in the case of a public service corporation, at least, its plain duty to the public. If a different course were pursued the only method of providing for replacement of property which has ceased to be useful would be the investment of new capital and the issue of new bonds or stocks. This course would lead to a constantly increasing variance between present value and bond and stock capitalization,—a tendency which would inevitably lead to disaster either to the stockholders or to the public, or both. If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon overissues of securities, or of omission to exact proper prices for the output, the fault is its own. When, therefore, a public regulation of its prices comes under question, the true value of the property then employed for the purpose of earning a return cannot be enhanced by a consideration of the errors in management which have been committed in the past."

In this authoritative announcement of the Supreme Court there is imposed upon the utility the duty, already imposed by the dictates of good management, of charging adequate rates to enable the protection of the integrity of the investment, and of properly applying the funds thus received to the use which justifies their collection.

The depreciation against which the integrity of the plant must be protected, is of two sorts: the first is termed physical depreciation. Physical depreciation is the loss of value due to the deteriorating influences of wear or age. This is the ravage of use and time which current maintenance does not repair. The second is termed functional depreciation. This is the loss of value resulting from lack of adaptation to function due to other causes than physical deterioration. It is of two sorts. One is that lack of efficient and economic adaptification to function which results from the existence of more efficient and economical equipment produced by improvements of the art. Another is that lack of adaptification which is the result of a growth or shrinkage of business, or of regulations requiring changes in construction and enforced by governmental authority. By reasons of these causes, reconstruction and replacements are required and equipment which is mechanically and physically sound is junked before the end of its normal life. It is with this risk and with these losses, and their effect upon the cost of service, that we are concerned. It is obvious that obsolescence and inadequacy are forms of depreciation. They affect the cost of service in a way similar to wear and tear, or physical depreciation.

In an age which will probably be known to future generations as the Age of Invention, science has made no greater nor more rapid advances than in the field of electrical engineering. In no business has there been a quicker or more zealous adoption of the discoveries of science than in the industries of electric light, power and traction. Concurrent with the progress of the science and its application in industry, there has been remarkable territorial expansion and the growth of cities. Urban population, and particularly that of the West, and in no part of the West as in the Northwest, has increased phenomenally. Towns have be-

come cities prematurely. The public demands and deserves the best of service. The duty of furnishing adequate service is a duty imposed upon the public service utility by common and statutory law. Thus the great problem which has faced these utilities of the Northwest has been that of giving adequate service to this rapidly growing population, when the equipment necessary to that service has been undergoing a process of rapid evolution. There has been a race, therefore, to keep up not only with the demands of the public, but with the progress of the science, and to secure from the public adequate compensation to pay the cost of progress. Here arises the problem of obsolescence and inadequacy.

Horse cars were superseded by cable cars. Electric cars took the place of cable cars and the expensive equipment of cable systems with narrow tracks and costly conduits were scrapped. Heavy electric rolling stock superseded the light electric rolling stock of pioneer days. Heavier equipment in cars required heavier rails, stronger bridges and bigger and better generating equipment. The path of progress is strewn, not with the wrecks of worn-out equipment, but with piles of good equipment, physically and mechanically sound and representing thousands of dollars of invested capital, upon which there has not been a complete return and the investment in which has not been regained by the investors in the form of adequate replacement annuities.

The phenomenon is familiar to every one. A most striking example has recently come to attention in the instance of the Harrison Street Station of the Chicago Commonwealth Edison Company. This plant was built in 1893 and placed in permanent service in 1894. The equipment consisted of high grade water tube boilers and compound and triple expansion engines directly connected to the generators. The maximum peak load upon the plant was 18,826 kw. This plant when constructed was a model of efficiency and economy. It embodied the most advanced products of engineering thought. Experts from the world came to this station to study advanced central station practice. The advance of science has been such, however, that no additional machinery was installed after 1903, and since 1910 the station has been used only as a reserve plant and for standby service. This year the plant has been demolished. It produced in the course of its history only 534,783,000 kw.-hr.

The very remarkable development of the turbine engine is one of the most striking instances of progress of the art. Turbines have rapidly superseded reciprocating engines. Improved and larger turbines in mammoth units are superseding the smaller turbines of the earlier models. Generators adapted to piston engine practice are not adapted to turbine engine practice. Higher pressure is needed from the boilers. Condensers must be changed to give better vacuum.

A similar development has been shown in the creation of new types of lighting equipment. One of the large utilities operating in the Northwest invested over \$50,000 in the Nernst lamp, only a few years ago. These lamps were expensive in cost and operation, and although a very decided improvement over any lamps which had been developed before that time, after a

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Sunlight is one of the worst enemies of rubber. It rots and destroys automobile tires very quickly. Covers should therefore be provided for all extra tires carried on autos.

* * *

An innovation is being put into practice by H. S. Cooper, secretary of the Southwestern Electrical & Gas Association, who visits the plants and properties of the members, taking from each new ideas and helpful information that may be passed along to the next plant in the district.

* * *

The net earnings of the U. S. patent office for the year 1915 amounted to over two hundred thirty-seven thousand dollars. This is the only governmental department which annually appears on the earning side of the ledger. Its total earnings now amount to over ten million dollars.

* * *

During the past several months the electric flag sign has enjoyed popularity and many of them have been installed in various cities of America. Flood lighting the American flag is now, however, becoming equally popular and from a spectacular standpoint even more effective.

* * *

As an example of the gigantic growth of the modern electric lamp business, one prominent eastern firm now employs five thousand workers and turns out seventy-five million lamps per year. If placed only fifteen feet apart this is sufficient in number to make a great white way from the earth to the moon.

* * *

The current consumption in the production of ice from raw water by the ammonia-compressor process varied from 52 to 98 kw.-hr., with an average of 71 kw.-hr. per ton in a plant served by the Texas Power & Light Company. The variation is due to operating characteristics and seasonal temperature changes.

* * *

For purposes of advertising and attracting the notice of automobile travelers approaching the city, an eastern hotel management has reaped rich harvests by erecting a high powered searchlight upon the top-most pinnacle of the building. This is an idea that should receive practical application in many places of the west.

* * *

During the last five years the growing of alfalfa has steadily developed in Argentina. It is estimated that in 1914 these were nearly twenty million acres of land thus employed in this great South American Republic. It would seem that American made electric pumps and motors ought to find a wide field of application in Argentina.

* * *

In climate and physical features northern Manchuria is strikingly similar to the Dakotas. The climate is exceedingly dry, sunny throughout the year, and healthful. In agricultural possibilities, especially

for grain, it is the most promising province in ancient China. Abundant opportunities for power development are also found there.

* * *

The stand of timber on the two great national forests in Alaska is estimated by the forest service as over 70,000,000,000 board feet, while the annual growth will, it is said, produce of pulpwood alone enough for the manufacture of 3000 tons of wood pulp a day.

* * *

The commercial department of the Pacific Telephone & Telegraph Company is evidently strongly impressed by the possibilities of a co-educational university town, as evidenced by the following requisition recently placed by the Palo Alto Exchange: "One 'osculating' electric fan, size 12 inches, 60 cycles, alternating current, 110 volts.

* * *

Both houses of Congress have now authorized the largest naval constructive program ever adopted by any nation in the world in an appropriation of some three hundred fifteen million dollars. The program contemplates beginning construction on 156 ships within the next three years, 16 of which are to be capital ships—four battle cruisers and four battleships the first year.

* * *

"When scientific work is solely with the object of securing commercial gain, its correlative is selfishness; when it is confined to the path of narrow specialization it leads to arrogance; and when its purpose is materialistic domination, without regard for the spiritual needs of humanity, it is a social danger and may become an excuse for learned barbarity."—Professor R. A. Gregory, in "Discovery, or the Spirit and Service of Science."

* * *

Various electrical inventions have been in recent years put on the market to replenish the oxygen in the air in stuffy rooms and in mines. The U. S. Bureau of Mines has found that atmospheres that are deficient in oxygen begin to affect men when the percentage of oxygen is about as low as that affecting canaries and mice. When the oxygen content is about 7 per cent mice show considerable distress, and a man is in grave danger of dying.

* * *

To make a successful fight against moving sand-dunes such as those of the Columbia River region and other places along the Pacific Coast, the United States must follow the plan adopted by France many years ago and build one great dune in an effort to eliminate many smaller ones. This is the verdict of the forest expert who has made a world-wide study of the subject. Some years ago three hundred miles of coast line on the Bay of Biscay was being blown inland by the winds of the Atlantic Ocean. The construction of a great artificial lateral dune along the coast line threatened saved the day for France.

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POWER AND GAS

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION ETC., required by the Act of Congress of August 24, 1912, of "Journal of Electricity, Power and Gas," published weekly at San Francisco, for October 1, 1916.

State of California,

County of San Francisco—ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared E. B. Strong, who, having been duly sworn, according to law, deposes and says that he is the business manager of the "Journal of Electricity, Power and Gas," and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Names of	Post Office Address.
Publisher, Technical Publishing Company.....	San Francisco, Cal.
Editor, A. H. Halloran.....	No. 6 Crossley Bldg., San Francisco
Managing Editor, A. H. Halloran.....	No. 6 Crossley Bldg., San Francisco
Business Manager, E. B. Strong.....	No. 6 Crossley Bldg., San Francisco

2. That the owners are:

E. B. Strong.....	San Rafael, Cal.
R. J. Davis.....	Berkeley, Cal.
A. H. Halloran.....	No. 6 Crossley Bldg., San Francisco
C. L. Cory.....	Nevada Bank Bldg., San Francisco
Robert Sibley.....	Berkeley, Cal.
Mrs. L. B. Storey.....	Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

E. B. STRONG, President.

Sworn to and subscribed before me this 19th day of September, 1916.
(Seal) CHARLES EDELMAN,

(My commission expires April 7, 1918.)

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Considerable dissatisfaction has been expressed among Western power companies regarding the preferential price that the electric heating licensee committee has granted the jobber in purchasing electric ranges. No objection is raised to the jobber being given a better discount than the central station on lamp-socket heating devices, whose market has been well developed, but the central stations feel that the electric range is still in the period of exploitation.

They argue that neither the jobber nor the dealer have as great an incentive to sell ranges as has the central station, whose real return comes from future sales of current consumed by the range. Their experience has shown that the present cost of selling a range is out of all proportion to the amount received from its sale. As the central stations are assuming the burden of the high cost of exploitation, they believe that they should be able to purchase the ranges at as low a price as do the jobbers, especially as they buy equally large quantities.

The jobber, on the other hand, argues that he is the legitimate channel for the wholesale distribution of electrical goods. He carries a large stock, assumes credit risks, serves a large number of retail dealers throughout a wide territory and employs a staff of specialized salesmen. Without the jobber, the small retailer could not exist. The retailer is in direct contact with the public, and can do much to make or mar a favorable public opinion of the public utility corporation.

The central stations find that a great deal of money must be spent in educational work and direct soliciting and demonstrating among consumers. The question here arises as to whether some of this money if spent in educating the dealer would not ultimately be more effective in selling ranges. An educative campaign among the dealers has been found to be a necessary preliminary to sales effort direct to consumers. When dealers fully understand the advantages of electric ranges their intelligent co-operation will do more to put stoves on lines than any amount of house-to-house canvassing by central station solicitors.

A long-range view of the matter is desirable. Immediate expediency should not stand in the way of eventual profits. Fundamentally, this is a proposition of live and let live. The central stations need the support of the jobbers and dealers in many ways. If they proceed regardless of such considerations, if they do not allow some slight advantages to co-workers, it is doubtful whether this support will be available in time of need.

The big way, the broad-gauge method of far-seeing men in such a case, is to make a slight sacrifice in order to gain great benefit. The central station, under this plan, should not begrudge the jobber a slight differential, for to the power company the profit comes not in the sale of the range, but in the sale of the current consumed by the range. By encouraging the activity of the jobber the power company thus increases current consumption.

The jobber has voluntarily assumed the task of teaching the dealer. He needs help and co-operation from the manufacturer and central station if his in-

struction is to be carried to the final fruition of better business for every branch of the industry. A ten per cent differential seems little enough encouragement for this and other services rendered by the jobber.

The discussion of open channels used for irrigation purposes which appears on another page of this issue will undoubtedly be welcomed by a large group of men interested in irrigation pumping. Especially for those interested in irrigation pumping for the small farm unit will this article prove of unusual value.

The Small Ditch and its Upkeep

Hitherto, the construction of the small laterals used for such purposes have largely been designed by rule of thumb. Recently derived theory and practice have in a large measure standardized this class of ditch construction and the author of this article has set forth methods of arriving at the proper proportion of parts to be used in any given case.

One of the strong points to bear in mind in proportioning ditches of this type is the lower limit below which ditches should not be designed.

The growth of weeds and grasses with its deleterious effect is also emphatically called to the attention of the reader. Orchardists in California and the West have long struggled with the advancing rate of growth of Bermuda and other grasses. At first it was thought that such growths simply made the irrigation system unsightly. In the case of rice growing, however, weeds and grasses appearing in the canals are found by their seed carrying power to materially effect the production of crops, to say nothing of their ability to reduce the carrying capacity of the ditch.

Indeed so harmful from every consideration has the growth of weeds and grasses in canals proven that now in many instances farmers and agriculturists generally are finding it far better to adopt concrete piping for canals in every instance possible.

Since open channels are far cheaper in construction, their use will, however, long play the leading role in farm irrigation methods. As a consequence the data set forth in this issue, the first of its kind to appear in collateral form, will undoubtedly be welcomed from all quarters.

Since engineers and farmers still use different languages in expressing the carrying capacity of ditches, for the sake of extreme clearness and usefulness in application of the data set forth in this article, three separate charts have been prepared, the first giving the carrying capacity in cubic feet per second, the second the carrying capacity in miner's inches, and the third in gallons per minute.

To be independent of charts, however, it is well to bear in mind that one cubic foot of water per second is by statute equivalent to 40 miner's inches in some Western States, while in others it is equivalent to 50 miner's inches. The charts constructed by the author adopt the latter unit.

Still another unit that often appears perplexing to the irrigationist is the acre foot and how to convert this unit with miner's inches or cubic feet per second.

An acre foot of water means such a quantity of water as will flood an acre to a depth of one foot. Since no time element appears in this unit, it is neces-

sary to introduce such a unit if a relationship between acre feet and cubic feet per second is desired.

Thus one cubic foot of water per second means a flow of 86,400 cubic feet in twenty-four hours. Since an acre flooded to a depth of one foot is equivalent to a storage of water of 43,560 cubic feet, it is evident that a cubic foot of water per second flowing for twenty-four hours must be drawn from a source having a storage capacity of almost two acre feet.

The theme of the water-fall has ever been interwoven into the daily hum-drum of human life, an enchanting veil of mystery and exquisite beauty. During the past twenty-five years, however, this thought has been transformed into the practical easing of human burdens brought about by means of the physical harnessing of the vast latent powers possessed by water as it passes in its journey from the mountain to the sea. In California this development has been marked to a greater degree than any other section of country in the world. Especially is this true in Central California where the perpetual melting of snow in the white-capped Sierras has made possible unusually favorable conditions for such development work.

Typical of this unprecedented growth in hydroelectric generation of power is the gigantic network of the Pacific Gas & Electric Company which generates its power in some eleven hydroelectric plants situated in the high Sierras and transmits this subtle electric force through fifteen hundred miles of pulsating, high-tension distribution lines, thereby serving with heat and light for the comfort of its citizens and with power for the driving of its industries a population of a million and three-quarters in thirty of California's counties.

A consideration of certain of the physical aspects of this great world beating system of hydroelectric transmission detailed on another page of this issue is not the only thing from which engineers and citizens of the West draw inspiration.

The men who have dreamed the dreams that have brought to reality this throbbing, life-giving enterprise in California are in themselves a source of inspiration to well-wishers of the West to a greater degree than the actual physical accomplishments they have brought about in harnessing these great natural burden-lifters.

It is most fitting that those having the matter in charge have named one of these new power plants in memory of James Hugh Wise, who was a young and enthusiastic engineer in the company's employ and who will ever remain a living source of inspiration to all who knew him, and to whom California and the West will ever be indebted for dreaming the dream that in a large measure made possible the Bear River scheme of development.

From the veteran worker of forty years' service who today stands at the head of this great corporation down through his corps of young, enthusiastic helpers, California and the West may well feel a sense of pride in contemplating the enthusiasm, loyalty of purpose and constructive imagination with which these men have performed their service to the state.

PERSONALS

J. W. Swaren of the Pelton Water Wheel Company, is making a month's trip East.

Robert Tchumay, electrical contractor of Visalia, Cal., was at San Francisco this week.

Percy H. Thomas, consulting engineer, is expected at San Francisco from New York this week.

Walter M. Fagan, representative of the Hughes Electric Heating Company, is at San Francisco.

F. H. Leggett, Pacific Coast manager Western Electric Company, returned to San Francisco this week from an extended eastern trip.

C. F. Conn has closed the San Francisco offices of the J. G. White Engineering Corporation and will leave for New York City early in October.

E. C. La Rue, United States hydraulic engineer, formerly at Salt Lake City, has been assigned to the special water-power investigation in Oregon.

Geo. Gray, Pacific Coast representative of the Condulet Company, has returned to San Francisco from a motorcycle trip through Southern California.

A. B. Day, manager of operation for the Los Angeles Gas & Electric Corporation, has been elected a member of the American Institute of Electrical Engineers.

H. S. Whiting, president Pierson-Roeding Company, leaves for Atlantic City this week to attend a convention of the district managers of the Aluminum Company of America.

A. E. Wishon, assistant manager and **E. A. Quinn**, general superintendent San Joaquin Light & Power Corporation, have returned to Fresno from San Francisco.

J. A. Herr, one of the most popular salesmen with the San Francisco office of the General Electric Company, left this week to join the sales force of the Boston office of the Sprague Electric Works of the General Electric Company.

H. M. Byllesby, president of H. M. Byllesby & Co., of Chicago; **O. E. Osthoff**, vice-president of the company; **H. L. Jackman**, manager at Eureka, Cal., and **H. H. Jones**, manager at San Diego, were at San Francisco during the past week.

E. H. Warner recently resigned as resident engineer for the Kern River No. 3 plant of the Southern California Edison Company in order to open offices at Los Angeles as consulting engineer. **F. E. Mills** has succeeded him at the power plant.

G. F. Chellis, electrical engineer with J. G. White Engineering Corporation, and **H. N. Keifer**, sales engineer with Northern Electric Company of Vancouver, B. C., have been transferred to the grade of member in the American Institute of Electrical Engineers.

S. C. Bratton, commercial manager Portland Gas & Coke Company, addressed the N. E. L. A. section of the Pacific Gas & Electric Company, September 26th, on the subject of "Up-to-the-Minute Selling Methods," his paper on which was awarded the gold medal by the Pacific Coast Gas Association.

W. G. Stearns, formerly in charge of the Portland office of the Standard Underground Cable Company, assumed the duties on September 1st of assistant to manager as well as continuing his duties as chief salesman for the San Francisco district.

D. C. Green, formerly connected with the organization of H. M. Byllesby & Co. as local manager at two Oregon and Washington properties, has been appointed general manager of the Fort Smith Light & Traction Company, Fort Smith, Arkansas, succeeding **H. C. Hoagland**, who has been managing that property in connection with his work as manager of the Muskogee Gas & Electric Company for some time past. Mr. Hoagland will continue as manager of the Muskogee Gas & Electric Company. The change took effect September 26.

C. B. Babcock, manager of the General Gas Light Company at San Francisco, has been elected president of the Pacific Coast Gas Association, **J. D. Kuster**, manager of the San Jose district of the Pacific Gas & Electric Company, vice-president, and **Henry Bostwick**, secretary to the president of the Pacific Gas & Electric Company, secretary-treasurer. The directors are: **F. S. Wade**, Southern Counties Gas Company, Los Angeles; **S. Waldo Coleman**, Coast Counties Gas Company, San Francisco; **H. W. Jackson**, manager James Graham Manufacturing Company, San Francisco; **C. A. Luckenback**, construction engineer Los Angeles Gas & Electric Corporation, Los Angeles; **John A. Britton**, vice-president Pacific Gas & Electric Company, San Francisco; **Z. T. Bell**, superintendent San Bernardino Valley Gas Company, San Bernardino; **Leon B. Jones**, assistant gas engineer Pacific Gas & Electric Company, San Francisco.

MEETING NOTICES.

Electrical Development and Jovian League.

The principal business transacted at the September 20th meeting was participation in the Path of Gold celebration. **T. E. Collins** reported that the League's float would be mounted on a long auto truck as no street cars were available. **Harold von Schmidt**, winner of the Society for Electrical Development's poster contest was introduced and announcement was made that an animated representation of his "Aladdin" poster would be incorporated in the league's float. **N. J. Prendergast**, as chairman for the day, then introduced **Arthur Arlett**, who gave a spirited talk in favor of prohibition.

Portland Sections N. E. L. A. and A. I. E. E.

The first regular meeting will take place Tuesday, October 10, 1916. The programme and entertainment has not been arranged.

The officers for the ensuing year are as follows:

N. E. L. A.—**J. C. Henkle**, chairman; **E. F. Whitney**, vice-chairman; **C. L. Wernicke**, treasurer; **H. H. Schoolfield**, secretary; executive committee, **O. B. Coldwell**, **A. S. Moody**, **B. C. Condit**.

A. I. E. E.—**L. T. Merwin**, chairman; **J. C. Martin**, secretary; executive committee, **Paul Lebenbaum**, **A. S. Moody**, **E. D. Searing**.

Programme and Papers Committee for Joint Meetings—**E. D. Searing**, chairman, **O. C. Brill**, **R. S. Monges**, **J. F. Rockwood**.

Entertainment Committee—**J. P. Grodon**, chairman, **C. R. Young**, **C. P. Osborne**, **R. M. Boykin**.

Luncheon Committee—**A. S. Moody**, chairman, **F. O. Broilli**, **E. H. Le Tourneau**, **W. D. Scott**.

Membership Committee—**A. C. MacMicken**, chairman, **Geo. G. Bowen**, **A. M. Sherwood, Jr.**, **G. P. Mock**.

Washington Association of Electrical Contractors and Dealers.

The first annual convention of the Washington Association of Electrical Contractors and Dealers at the Butler Hotel, September 19th. The meeting was opened by an address of welcome by the president, **V. S. McKenny**, who welcomed the contractors and visitors present and asked that they make themselves at home and enjoy themselves. **J. J. Agutter**, vice-president of the Washington Association, read a fine paper entitled, "The Washington Association, its History, Purpose and Aims." **C. C. Hillis** president of the Pacific Coast Jobbers' Association, read a paper on "Co-operation and Education," briefly abstracted as follows:

The gist of Mr. Hillis' argument was that co-operation is education. Business men realize that they can accomplish more for themselves by cultivating the acquaintance of their competitors than by fighting them. The problems of the industry can be solved by team work. The greatest benefit derived from association effort is in its educational features and in creating confidence. "To be a true co-operator, when you will not only have confidence in your competitors, but they



Group of Those Attending First Annual Convention Washington Association of Electrical Contractors and Dealers.

will have confidence in you, takes time. Yet as a result, the many hours given to your business each day will produce not only greater material returns, but many pleasant thoughts of the men who have labored for the same end, and yet are your competitors."

P. J. Aaron of the Fobes Supply Company submitted a paper on Trade Acceptances which will be printed next week in these columns.

N. W. Graham of Los Angeles and W. S. Berry of San Francisco told what the contractors' association has accomplished for the electrical industry from the jobber's standpoint. F. J. Somers, president of the California association, spoke of what the contractors' association has accomplished for the electrical industry from the contractors' standpoint, and Albert H. Elliott, secretary of the Pacific Coast Electrical Jobbers' Association gave a fine address on the need of co-operation, education and confidence in the electrical industry.

In the afternoon a large volume of business was transacted, including a resolution, unanimously adopted, that the association indorse and assist "America's Electrical Week" to be conducted by the Society of Electrical Development.

The matter of the forming of a Western Conference Board with representatives from the coast states was approved and the rules governing same were adopted. Several changes in the constitution and by-laws were submitted and accepted.

The election of officers resulted as follows: President, V. S. McKenny (re-elected); vice-presidents; Seattle District, J. J. Agutter, W. M. Meacham and S. G. Hepler; Tacoma District, C. A. Young; Spokane District, Hugh L. Tinling and W. E. Chase; for North Yakima, H. H. Gladston, and for Bellingham, Mr. Clark. The forming of a district for Walla Walla was referred to the executive committee.

In the evening a banquet was held with 79 persons present, the principal speaker of the evening being Albert H. Elliott of San Francisco, whose address was greatly appreciated by all who heard it and greatly impressed them of the movement of association work. Five minute talks were made by H. J. Gille of Seattle, W. M. Meacham and Hepler of Seattle; Secretary Allison of the Washington Association; J. W. Oberender of the Oregon Association; Harry Sroufe of Portland; F. J. Somers of San Jose and Mr. Reese of Victoria, B. C. Throughout the banquet there was rendered a musical and vocal program and all present were greatly entertained. Mr. V. S. McKenny acted as toastmaster, and left nothing to be desired for entertainment and good fellowship. September 20th was taken up in an exceptionally fine auto trip to the summit of the Cascade Mountains and a fine chicken dinner was enjoyed at the Summit Inn.

Those attending the convention were:

A. M. Asselatine, Metropolitan Electric Co., Seattle.
Chas. L. Moses, Metropolitan Electric Co., Seattle.
C. A. Norton, Westinghouse Lamp Co., Seattle.
C. V. Aspinwall, Westinghouse Lamp Co., Seattle.
P. Stewart, Westinghouse Lamp Co., Seattle.
R. W. Clark, Puget Sound Trac., Light & Power Co., Seattle.

H. J. Gille, Puget Sound Trac., Light & Power Co., Seattle.
R. Muffley, Puget Sound Trac., Light & Power Co., Seattle.
J. R. Juvett, Stewart Electric Co., Seattle.
J. F. NePage, NePage, McKenny Co., Seattle.
V. S. McKenny, NePage-McKenny Co., Seattle.
S. A. Sizer, NePage, McKenny Co., Seattle.
C. A. Martin, Pacific States Electric Co., Seattle.
F. J. Zorn, Pacific States Electric Co., Seattle.
A. S. Moody, Pacific States Electric Co., Portland.
T. E. Bibbins, Pacific States Electric Co., San Francisco.
H. J. Woodward, Pacific States Electric Co., Seattle.
Roy Worth, Pacific States Electric Co., Seattle.
J. I. Colwell, Western Electric Co., Seattle.
F. N. Cooley, Western Electric Co., Seattle.
John F. Ryan, Western Electric Company, Portland.
W. S. Berry, Western Electric Co., San Francisco.
L. L. Brown, Western Electric Co., Seattle.
James Kelly, Western Electric Co., Seattle.
W. E. Peters, Western Electric Co., Seattle.
J. J. O'Reilly, Western Electric Company, Seattle.
P. J. Aaron, Fobes Supply Co., Seattle.
Frank Parrish, Fobes Supply Co., Seattle.
H. B. Harris, Fobes Supply Co., Seattle.
P. J. Avord, Fobes Supply Co., Seattle.
H. E. Barley, Fobes Supply Co., Seattle.
Harry Byers, North Coast Electric Co., Seattle.
Arthur Hein, North Coast Electric Co., Seattle.
J. G. Parkhurst, Tacoma Electric Fixture Co., Tacoma.
J. E. Foss, Foss Electric Co., Bremerton.
A. E. Griswold, A. G. Griswold Elec. & Mfg. Co., Seattle.
H. H. Hoxie, Electric Ry. & Mfrs., Supply Co., San Francisco.
Roy E. Young, Contractor, Seattle.
S. B. Gregory, Arrow Electric Co., San Francisco.
George T. Bryant, North Coast Electric Co., Seattle.
J. J. Agutter, J. J. Agutter Company, Seattle.
D. J. Metcalf, Queen Ann Electric Shop, Seattle.
Chas. Burrett, Contractor, Spokane.
I. P. Moss, Contractor, Spokane.
C. A. Duncan, Duncan Electric Co., Spokane.
Hugh L. Tinling, Hulton & Tinling Electric Co., Spokane.
A. F. Cook, Inland Electric Co., Spokane.
Mahlon McCain, Austin & McCain, Spokane.
Brewster Hall, Pass & Seymour, San Francisco.
S. G. Hepler, Arrow Electric Company, Seattle.
W. M. Meacham, Meacham & Babcock, Seattle.
H. D. Allison, Secretary Washington Association, Seattle.
Herbert C. Mess, A. H. Cox & Co., Seattle.
C. H. E. Williams, Contractor, Seattle.
T. B. Bennett, Contractor, Seattle.
F. W. Rust, Ranier Electric Co., Seattle.
J. H. Reardon, Reardon Electric Co., Seattle.
Geo. B. Cooley, Buxbaum & Cooley, Seattle.
Rush McGargar, Ally Electric Shop, Seattle.
H. A. Wilson, Contractor, Seattle.
M. L. McMurtrey, Electric Supply & Fixture Co., Walla Walla.
G. R. Labberton, Contractor, North Yakima.
C. K. Bogart, Electric Maintenance Co., Vancouver, B. C.
H. W. Rankin, Rankin & Cherrill, Spokane.
J. W. Oberender, Secretary Oregon Association, Portland.
Harry Sroufe, NePage, McKenny Co., Portland.
F. J. Somers, Century Electric Co., San Jose.
Harry D. Reese, Carter Electric Co., Victoria, B. C.
R. B. Wiseman, Electric Supply & Fixture Co., Ellensburg.
Albert H. Elliott, Secretary Jobbers' Association, San Francisco.
J. O. Lushington, Lushington Electric Co., Seattle.
F. B. Lushington, Lushington Electric Co., Seattle.
L. Schaffer, J. J. Agutter Co., Seattle.
Robert E. Curtis, Curtis Electric Co., Seattle.
T. N. Bristow, H. B. Squires Co., Seattle.
L. D. Spencer, Contractor, Seattle.
J. G. Maitland, Maitland Elec. Eng. Co., Seattle.
R. K. LeGrand, Electric Fixture Co., Seattle.
C. H. Birkel, Birkel Eng. Co., Seattle.
E. C. Leighton, Leighton Eng. Co., Seattle.
F. R. Beattie, Contractor, Seattle.
F. G. Larkin, Telephone Equipment Co., Seattle.
F. T. Richards, Contractor, Seattle.
C. C. Hillis, Electric Appliance Co., San Francisco.
H. E. Sanderson, Bryant Electric Co., San Francisco.
N. W. Graham, Holabird-Reynolds Co., Los Angeles.
F. E. Smallidge, Electric Supply Co., Wenatchee.
W. E. Chase, Chase Electric Co., Spokane.
F. J. Curran, Curran Sign Co., Spokane.
P. D. Depeyter, Power City Electric Co., Spokane.
C. A. Snelark, Clark Electric Co., Bellingham.
F. P. O'Donnell, F. P. O'Donnell & Co., Seattle.



NEWS NOTES



ILLUMINATION.

FORT BIDWELL, CAL.—The board of supervisors will receive bids up to October 2 for installing lights in the Bidwell Lighting District.

FULLERTON, CAL.—Plans to illuminate the streets of the city with ornamental lighting posts have been temporarily dropped by the city council.

VISALIA, CAL.—Trustees Gibson and Young have been instructed to investigate the cost and other details of an adequate electrolier lighting system for the business district.

PALO ALTO, CAL.—The city council is taking steps to call a bond election to provide funds for the purchase by the city of the distributing system and storage tanks of the Palo Alto Gas Company, valued at \$65,000.

LOS ANGELES, CAL.—A contract has been awarded by the board of supervisors to the California-Arizona Construction Company for concrete lighting posts on W. Adams street in Bon Meadows at a cost of \$21,539.

LOS ANGELES, CAL.—Petitions for additional lights in the Verdugo and Lankershim Lighting Districts have been granted by the board of supervisors and the city engineer has been requested to prepare specifications.

FORT BIDWELL, CAL.—W. D. Hill and I. H. Skillman have taken out a certificate to furnish light and power to Bidwell West, Bidwell East and Lake City precincts of Modoc County, under the name of the Bidwell Electric Company.

IDAHO FALLS, IDAHO.—An ordinance has been passed by the council granting Wm. D. Wilcox the right to construct pipe lines through the streets of Idaho Falls, for the purpose of conveying artificial gas, the franchise to run 50 years.

TEMPE, ARIZ.—The construction of a lighting plant is being considered by the council. The cost of the work is estimated at \$26,000. The purchase of the present holdings of the South Side Gas & Electric Company is also being considered.

BOISE, IDAHO.—A hearing will be held at Wallace by the commissioners, October 9, on the application of the Roberts-Inskip Plumbing & Heating Company for a certificate of public convenience and necessity for a heating and lighting plant they wish to build in Wallace.

TRANSMISSION.

FRESNO, CAL.—At present there are about 300 men at work in the vicinity of Huntington Lake and Cascade preparing for the construction work that will further develop the Big Creek project.

RIVERSIDE, CAL.—The City Electric Supply Company of this city has secured the contract for electric transmission lines, telephone lines and substation work on the Lindsay-Strathmore irrigation project, on its bid of \$31,000.

BELLINGHAM, WASH.—The construction of a new power plant above Marblemount on the Skagit River is indicated by the filing of three water power rights by G. M. U. Tait of Seattle, permitting him to divert 15,000 cu. ft. of water per second from three various places in the course of the Skagit River in Whatcom County. The purpose of the plant is to furnish electric power to railways, manufacturing concerns, etc.

TRANSPORTATION.

MARYSVILLE, CAL.—The Los Verjels Land & Water Company is planning to install an electric road from Bangor to connect with the Northern Electric at Oroville.

SAN FRANCISCO, CAL.—The public utilities committee of the board of supervisors will shortly take up the question

of building an extension to the municipal street railway down Baker street to the Palace of Fine Arts and the proposed new State Normal School in the California building.

STOCKTON, CAL.—A movement has been instituted by the Stockton labor union bodies for the purchase by the city of the street car lines of the Stockton Electric Railroad Company. Communications were received from the Central Labor Council, the San Joaquin County Building Trades Council, the Stockton Improvement Club and the South Stockton Improvement Club and filed with the council requesting that consideration be given the matter of purchasing the street railroad. In each case resolutions adopted by the bodies were inclosed, the resolutions being identical.

IRRIGATION.

FAIRPLAY, CAL.—After a trial of the irrigation ditch of the Howard-Haywards-Lane interests the residents of Fairplay have decided to take steps to form an irrigation district and take over the ditch from the company.

FRESNO, CAL.—Representatives of Miller & Lux conferred with a committee of farmers of the Madera county plains over the project to irrigate more than 400,000 acres of land by a vast system of storage dams, supplied by the San Joaquin River.

MONTAGUE, CAL.—The Big Springs district has been the center of activity in the Shasta Valley during the summer and the project is rapidly nearing completion. The large centrifugal pump has been installed for several weeks and has been running constantly.

OROVILLE, CAL.—The Western Canal Company has a crew of surveyors at work running lines from the present terminus of the ditch in the Dodge rice plantation to the Sacramento River near Butte City. It is understood that a number of Butte City landowners are anxious to secure water from the ditch.

SUSANVILLE, CAL.—Petitions are on file asking the supervisors of Lassen County to call elections for the organization of two more districts. One of the proposed districts will furnish water to 7000 acres in the Janesville section and the other, known as the Southern Lassen District, will irrigate about 35,000 acres in Long Valley.

MODESTO, CAL.—A resolution providing for the calling of an election in compliance with petitions filed several weeks ago for the purpose of forming a public utilities district including the territory in the Modesto and Turlock Irrigation districts was passed at a special meeting of the county board of supervisors. The date for the election was left for future determination.

TELEPHONE AND TELEGRAPH.

TUCSON, ARIZ.—It is stated that Tucson will have a complete new Western Union Telegraph Company station shortly.

OROVILLE, CAL.—The local wires of the Western Union Telegraph Company may be placed underground. This would cost about \$2500.

GLOBE, ARIZ.—Plans are being perfected for the betterment and extension of the telegraph service of the Western Union Company in this district.

SAN BERNARDINO, CAL.—The Home Telephone Company has now in process of completion the placing of underground cables within the business district. The switchboard is also to be improved. The equipment, together with underground work represents an outlay of approximately \$25,000.

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Sockets—Brass Shell—(Continued.)

List.	Sell.
Mogul, Without Shade Holder.....	1.00
Mogul, With Shade Holder.....	1.30
Twin Keyless, 3/8-inch.....	.70
Twin Pull Chain, 3/8-inch.....	1.06
Twin Keyless Extension.....	1.00
Angle, 3/8-inch.....	.35
Angle, 1/2-inch.....	.41

Sockets—Wall.

Key, Brass Shell.....	.44
Keyless, Brass Shell.....	.40
Keyless, Porcelain Base.....	.40
Key, Porcelain Base.....	.44
Pull Socket, Porcelain Base.....	.70
Key Angle, Porcelain Base.....	.55
Keyless Angle, Porcelain Base.....	.50
Pull Angle, Porcelain Base.....	.70
Mogul, P. & S., No. 520.....	1.00

Sockets—Porcelain.

Key Pendant Socket.....	.30
Keyless Pendant Socket.....	.25
Key Socket, 1/8-inch.....	.35
Key Socket, 3/8-inch.....	.35
Keyless Socket, 1/8-inch.....	.30
Keyless Socket, 3/8-inch.....	.30
Mogul.....	1.00
Pull Chain, 1/8-inch.....	.85
Pull Chain, 3/8-inch.....	.85

Sockets—Weatherproof.

Porcelain.....	.12 1/2
Composition.....	.24
Hard Rubber.....	1.00

Sockets—Miniature and Candelabra.

Keyless.....	.23
Pull Chain.....	.60
Key.....	.33
Porcelain.....	.07 1/2
Weatherproof.....	.12

Sockets—Decorative Lighting.

Porcelain, Temporary.....	.24
Mica, Temporary.....	.30
Cleat, Temporary.....	.18

Solder.

Solder, per lb.....	.50
Solder Paste, per 2 oz. can.....	.15
Solder Sticks, each.....	.40

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

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Rosettes.

List.	Sell.
Porcelain, 3/4-inch Box.....	.15
Porcelain, 4-inch Box.....	.20
Porcelain, with Clips, 3/4-inch Box.....	.25
Porcelain, with Clips, 4-inch Box.....	.30
Brass Shell, 3/4 x 4-inch.....	1.00
Cleat Rosettes, each.....	.20
Concealed Rosettes, each.....	.20
Moulding Rosettes, each.....	.20

Slate (Black).

10x 9x 7/8.....	.55
12x10x 7/8.....	.75
14x10x 7/8.....	.85
12x12x 7/8.....	.95
14x14x 7/8.....	1.40
16x12x 7/8.....	1.30
16x16x 7/8.....	1.85
18x12x 7/8.....	1.60
18x14x 7/8.....	1.75
18x17x 7/8.....	2.05
18x18x 7/8.....	2.35
19x18x 7/8.....	2.50
22x18x 7/8.....	2.75
24x18x 7/8.....	3.25
25x18x 7/8.....	3.35
27x18x 7/8.....	3.60
30x18x 7/8.....	4.05
33x18x 7/8.....	4.35
36x18x 7/8.....	4.85
38x18x 7/8.....	5.50
41x18x 7/8.....	5.80
43x18x 7/8.....	6.10
48x18x 7/8.....	6.70
51x18x 7/8.....	7.25
53x18x 7/8.....	7.65
56x18x 7/8.....	7.90
30x24x 7/8.....	5.30
48x30x1 1/2.....	22.05
60x30x1 1/2.....	15.95
60x18x1 1/2.....	13.00
1/2-in. x 3-in. Linings for above sizes, per Lineal Foot.....	.40
Rheostat Drilling, per Hole.....	.08

Sockets—Brass Shell.

Key Socket, 1/8-inch.....	.33
Key Socket, 3/8-inch.....	.39
Key Socket, Pendant.....	.33
Keyless Socket, 1/8-inch.....	.33
Keyless Socket, 3/8-inch.....	.30
Keyless Socket, 1/2-inch.....	.36
Keyless Socket, 3/8-inch, Male Thread.....	.39
Pull Socket 1/8-inch.....	.60
Pull Socket, 3/8-inch.....	.66

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

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Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco. |
| B-1 Baker-Joslyn Company..... 3
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco. | N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco. |
| C-1 Century Electric Co..... 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore. | N-3 National Lamp Works of G. E. Co.....
(All Jobbers.) |
| C-3 Crocker-Wheeler Co..... 3
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629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co..... 5
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles. | N-6 National Carbon Co.....
Cleveland, Ohio. |
| D-4 Davis Slate & Manufacturing Co..... 3
Chicago, Ill. | O-1 Okonite Co. (The)..... 12
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Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles. | P-4 Pelton Water Wheel Co..... 11
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| E-2 Edison Storage Battery Co..... 11
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Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, OCTOBER 7, 1916

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BY BAYARD W. MENDENHALL.

TRADE ACCEPTANCES FOR THE ELECTRICAL CONTRACTOR.

BY P. J. AARON.

DESIGN OF SMALL LINED CANALS.

BY S. T. HARDING.

PURCHASING.

BY N. L. MORSE.

THE COST OF PROGRESS.

BY LESLIE CRAVEN.

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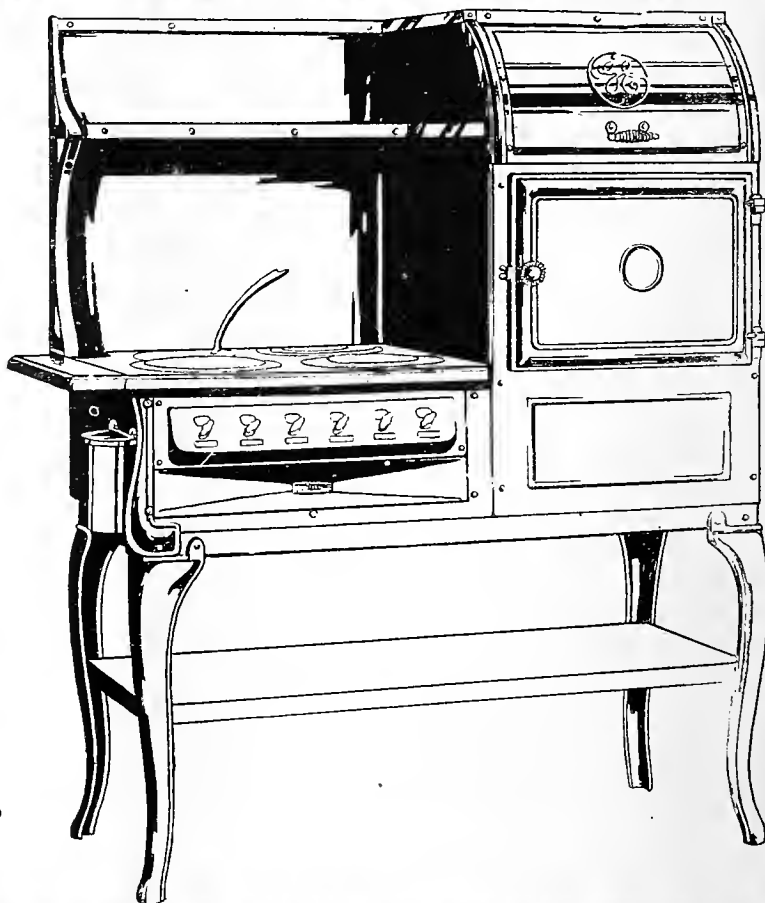
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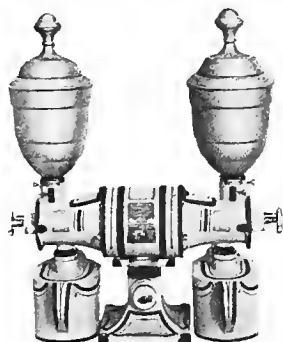


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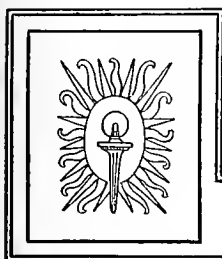


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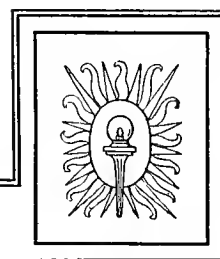
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VOLUME XXXVII

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ILLUMINATION AT SALT LAKE CITY

BY BAYARD W. MENDENHALL



The Beautiful Lighting Effects at Salt Lake City.

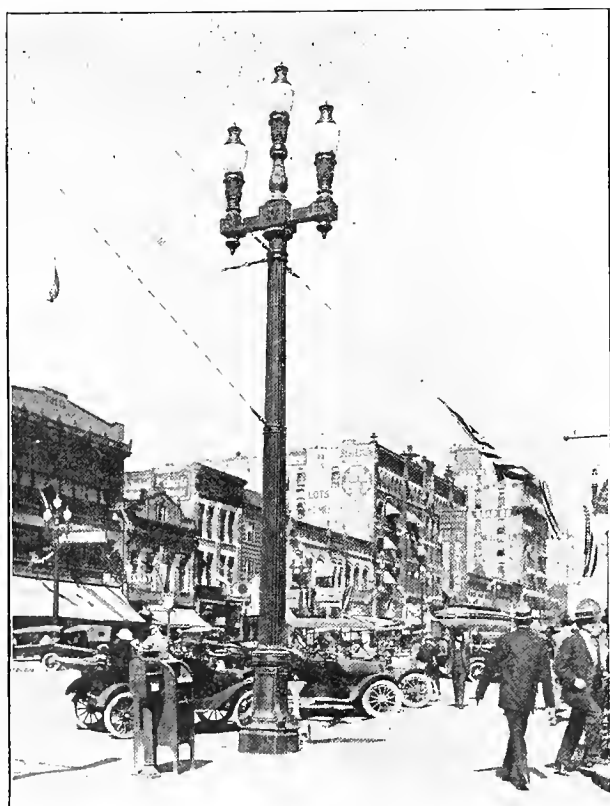
Salt Lake City celebrated the inauguration of its new "White Way" lighting district on the evening of September 29th with impressive ceremonies.

This new lighting system, which is generally referred to as the Salt Lake System, extends from South Temple street to Fifth South street on Main street, a distance of five blocks or approximately three-quarters of a mile. It covers the entire retail business district on this main street. There has previously

been more or less rivalry between the upper and lower main street merchants and property owners, and since this system has been inaugurated it is believed sectionalism will vanish on the street.

President F. C. Richmond of the Salt Lake City Commercial Club, which has co-operated with the various interests in making this splendid system possible, acted as master of ceremonies and introduced the speakers.

In order to make the system permanently successful it was decided to appoint a committee to take up with the legislature, then in session, the proposition of amending the law already on the statute books creating special lighting improvement districts, this law having been found not to be in conformity with other laws pertaining to special assessments. The Commercial Club and others interested in the proposition co-operated with the committee and succeeded in having the law properly amended and signed by the governor. Petitions were then circulated among property owners. As originally contemplated, only one block on upper Main street would be installed, but as the movement progressed, first one block and then another was added until finally petitions were presented to the city council asking them to create a lighting improvement district covering five blocks on Main street. On March 20, 1916, the city commission passed a resolution declaring their intention to make this improvement in accordance with the provisions



Typical Ornamental Lamp Design at Salt Lake City.

of the law. Subsequently bids were had, the contract was awarded to the Utah Power & Light Company and the work started. It was originally intended to have the system in operation by midsummer but this was found impossible owing to the delay in securing the material from the manufacturers.

Mr. Ryan, the designer of the system, whose zeal and enthusiasm had been so potent in securing the confidence of the property owners and in convincing them that the system would be all that he promised for it, had made a special trip from San Francisco to attend the ceremonies and was greeted by rounds of applause when President Richmond introduced him as the man who had made the Panama-Pacific Inter-

national Exposition famous by the lighting system he had designed for it. Mr. Ryan stated that on account of its broad streets, Salt Lake presented an unusually interesting problem in special street lighting design. He called attention to the fact that he had promised the property owners that they should have a substantial, dignified, standard with an evenly distributed illumination well out of the eyes of the pedestrians, which would give a practically uniform distribution of light on the street, sidewalk and facade of the buildings. He called upon the throng present when the system was turned on, to witness how nearly his promise had been fulfilled. He closed by declaring, "The West has always done the pioneering. Tonight we are making history. I am proud to have been associated with this magnificent piece of Western enterprise."

The Hon. W. Montgomery Ferry, mayor of the city, was the last speaker. He praised the progressive citizens of Salt Lake City which made this enterprise possible, thanked those responsible for its being, and declared that this type of lighting hereafter would be known as the Salt Lake system and that Salt Lake City would derive much desirable publicity therefrom.

The old street lighting system was then extinguished and the new one turned on. The band played, the crowds cheered and gazed about them in wonder.

There are seven standards to the block on each side of the street approximately one hundred feet apart. Each standard carries three six and six-tenths ampere inverted type G. E. luminous arc lamps. The standard fits over the regular trolley pole and completely conceals it. It has an ornamental cast iron base and a pressed steel column in two sections with the three armed cast iron fixture carrying the lamp mounted on top. The lamps are equipped with diffusing glass ware. Each lamp is rated at 1500 candle power and the absorption is approximately 30 per cent. They are connected on two circuits, one circuit supplying 190 lamps, which operates until midnight, the remaining twenty lamps burn all night.

The total cost of installation of the system was \$28,220. The cost to the property owners was \$25,535, and the city bore the balance of the expense. The installation charges against the property owners amount to \$4.12 per front foot. The total cost of operation for the three-year period of the contract is \$28,138, of which amount the city pays approximately \$4000. The cost of operation to the property owners is approximately \$1.30 per front foot per year. The Utah Power & Light Company spent approximately \$12,000 for rectifiers and other station equipment necessary to supply the installation.

The city issued to the Utah Power & Light Company in payment for the cost of installation and for the cost of operation for the period of three years, over which the contract runs, lighting improvement district bonds, which bonds are secured by a mortgage which is a first lien on the property included within the lighting improvement district. The company had no difficulty in disposing of these bonds at par. The property owners have the option to pay the cost of installation and operation in full or to pay it in three annual installments.

TRADE ACCEPTANCES FOR THE ELECTRICAL CONTRACTOR.

BY P. J. AARON.

(Here are some practical ideas on how to improve credit conditions in the electrical contracting business. An account is also given of the use of trade acceptances at Portland. The suggestions formed the concluding portion of a paper presented at the Seattle convention of the Washington Association of Electrical Contractors and Dealers. The author is with the Fobes Supply Co. at Seattle.—The Editor.)

If the jobbers will put trade acceptances into use, it will eventually come about that the contractors will use them with their customers. The fact that contractors have to settle their accounts with trade acceptances will be an argument which they can use to their customers. I do not pretend to say that the contractors can use them in all cases, to start with at least, but today there are a great many cases to which these trade acceptances would be applicable.

You have all had the experience of finishing up a job which was to be paid for possibly on the tenth of the month following, and when you went around to collect, your customer informed you that he was sorry but he would be unable to settle the account today, owing to the fact that he expected to get a loan, or so and so was not there, or this excuse and that. But at the time he made no criticism of the job. You felt that the customer was perfectly responsible and solvent. You did not want to use your lien rights. Therefore, the only thing to do was to wait, especially as you expected him to have additional business for you some time in the future. This account finally dragged out, perhaps a month, perhaps sixty days, and when they finally got around to pay you they began to take up counter-claims; your wireman damaged the tinting in some room, or there was to have been a switch at the head of the stairs, which was not put in, or the foreman on the job had promised them a set of three-way switches and they are not there, or there was to have been a light in the attic,—which claims are set up with the idea of getting a discount or for the purpose of obtaining more time to settle the account. The job having been completed for some time makes it hard to run down these claims, and perhaps the man that did the work has left your employ.

If at the time payment was due on the job you had gone to this party and said, "I am willing to give you additional time, but I want a trade acceptance, the job is completed and payment is due"—the customer could offer no argument against giving you this trade acceptance for thirty days, or sixty days if you saw fit to grant it to him; and if he does refuse under these conditions to give you an acceptance, my advice is that it is time that you protected your interest against the property. If he has any complaints, the time to make them is at the finish of the job. If he signs your acceptance he is barred against complaints when the time for payment comes.

If you do get acceptances and do not have arrangements whereby you can bank them yourselves, the jobbers will undoubtedly take them from you and give you credit. You will thus have a much larger share

of your assets working for you all the time than you do under the present methods of doing business.

The jobber's adoption of the trade acceptances in doing business with you would stop your over-buying, it would help to prevent your contracting in a class where you do not belong, as it would put squarely up to you the matter of financing your own business to a greater extent than you are required to do now, and it would tend to make you better business men.

In operation, some customers will fail to pay when the acceptances come due, and in such cases, of course, the endorser has to make good. Some of you may offer this as an objection to taking trade acceptances from your customers, but this is not a criticism of the system but a criticism of the individual. Is it any worse for you than if you had that man's account on your books? In other words, if you had a trade acceptance for \$100 due on the tenth of the month and the customer failed to pay, you would have to take it up from whomever you had discounted it to, and then charge it back on your books to your customer. You are in the same position then as though his account was an open account on your books during all that time, the only thing you lose being the interest rate at which the acceptance was discounted, and as an offset to this you have had the use of the money during that period.

If all the accounts owing you in dollars and cents were owed you by one customer, and you took a trade acceptance from him, I grant you there would be some danger in the transaction. But of every \$1,000 owing you the chances are the acceptances would run from \$25 up to \$400 or \$500, and the general experience has been that only about ten per cent of trade acceptances are dishonored. Therefore, out of this \$1,000, you might possibly have \$100 to take back. But \$900 of the \$1,000 is yours to use at the time the acceptances are taken, and how much better that is than to have this \$1,000 on your books dragging along through the same period and perhaps only realizing \$400 or \$500 out of it.

In case a jobber takes acceptances from you and you fail to meet an acceptance when it comes due, you are not going to be put out of business at once. It simply means that the jobber has to dig up the money for this acceptance and he then must decide what he is going to do to you to cause you to pay. He may see fit, if conditions are right and proper, to take a note from you; or he may see fit to carry the acceptance for a week or ten days or he may sue you. But any way it is finally settled this dishonored acceptance is going to be a red flag in the collecting department of that jobber, and unless the contractor makes good in a reasonable time on this dishonored acceptance that jobber will be a fool if he extends any more credit to that account. To me this feature of the trade acceptance is the biggest asset of all to the jobber.

In Portland we have worked out a plan for the use of these acceptances. This plan applies to September business and will be used in the settlement of our October first statements. It does not apply to old balances which we may have against contractors and dealers, but it takes a fresh start with purchases made after September 1, 1916. The old balances will have to be worked out from time to time and cleared up as

conditions will allow. So far as I know no other jobbing house has at yet put in any plan using trade acceptances, but I have hoped that a number of them will follow our lead. Of course, if our plan is wrong and does not work out successfully, we will have to go back to the old system, but I sincerely trust that we will not find this necessary. Our plan has the approval of the majority of the Oregon contractors and is worthy of consideration by you.

Briefly the plan is as follows: By paying our invoices ten days from date we will allow all cash discounts shown on the invoices. This means that the five per cent invoices can be picked out and paid and the balance of the invoices allowed to go through to statement if desired.

By paying our total invoices twice a month, those from the 1st to the 15th by the 25th, and those from the 15th to the 31st by the 10th of the following, we will allow all the cash discounts shown on the invoices.

By paying our monthly statement on the tenth of the month following we will allow a flat two per cent discount on the entire statement, with the exception of rubber covered wire, weatherproof wire, lamp cord, bare wire, annunciator wire, and such items as carry no discount.

If the customer, instead of paying the statement on the tenth of the month following, wishes an additional thirty days, and will give us a trade acceptance covering the statement in full, we will credit him not only with the acceptance but with a flat one per cent discount, with the exception of the items last enumerated.

In case a customer needs sixty days beyond the tenth of the month following his purchases, and he will make special arrangements with us for this time (which special arrangements of course consist in convincing us that his affairs are in such condition that we are willing to grant this time), we will take a sixty day trade acceptance from him, not allowing any discount.

These acceptances do not carry interest and the sixty day acceptances means that the contractor will be paying for September purchases on December tenth following.

In case our statements are not settled either by cash or by trade acceptances we will charge 8 per cent interest, such interest dating from the date of the statement. You will realize that this interest charge is not made with the desire to collect interest, but is made for the purpose of getting all of our customers to settle our statements either by payment or by the acceptances. You will also realize that the matter of credit still enters into the transaction, and the fact that we are now about to take trade acceptances does not mean that we will extend credit to those who are not entitled to credit under the old terms.

The average discount rate at which the banks will handle an acceptance is six per cent, and I want to give you an example of how our plan operated from the standpoint of net results.

We will suppose a customer during the month of September buys \$100 worth of pipe on four or five invoices. If he paid these invoices ten days from date, or paid twice a month, he would be entitled to a five per cent discount and we, therefore, would realize,

\$95 net on the account. If he paid his statement on the tenth of the month following he would be entitled to two per cent and we would, therefore, realize \$98 out of the account. If he settled his account by a thirty day acceptance he would be entitled to one per cent and we would therefore receive \$99 from him, but it would cost us 50c to discount this thirty day acceptance so we would really realize \$98.50 on this \$100 account. If he settled with us by a sixty day acceptance he would get no discount and we would receive from him the \$100, but it would cost us \$1 to discount the acceptance and we would realize but \$99 out of the transaction.

You will note that in the three last instances, namely, payment by customer of statement, settlement by thirty day acceptance, and settlement by sixty day acceptance, that we realize in cash on the tenth of the month following the sale \$98 in the first instance, \$98.50 in the second instance, and \$99 in the third instance. The \$98 settlement is complete, in that he paid cash on his statement; the \$98.50 instance is not as yet absolutely complete as we are an endorser on his acceptance and for this endorsement we are realizing fifty cents. In the \$99 case the transaction is not entirely completed as we are endorser on his sixty day acceptance and we are realizing \$1 for such endorsement.

This plan which we are putting in is not just what I would wish it to be, but is as far as we can go without materially changing the present methods of doing business, and this we cannot do without the co-operation and approval of the contractor and dealer, and the co-operation and approval of competitive jobbers. I believe the time will come, however, when all will realize that the present methods of doing business must change, and that eventually a firmer plan than the one we are about to use can be worked out that will put the jobber-contractor-dealer business on a higher plane. I firmly believe that this plan if carried out to the proper co-operative extent would cure seventy-five per cent of the troubles that exist in our business today.

WATER SUPPLY FOR THE CITY OF SACRAMENTO.

A report upon "Possible Sources of Water Supply for the City of Sacramento, California," by Messrs. Hyde, Wilhelm & Miller, has just been printed. Various sources were considered, including the pumping of ground waters from an area east and southeast of Sacramento. Investigations of well records, present development and sources of replenishment were made. It was concluded that the main source of the deeper ground waters in the vicinity of Sacramento are derived largely from the direct percolation of rain rather than from seepage from stream channels. The ground waters have a slope south of westerly of about 4 ft. per mile and are estimated to have a velocity of only 540 ft. per year. It was concluded that the supply was insufficient for the future supply of Sacramento and also that the legal complications which might later arise with overlying land owners who might pump for the irrigation of their lands might add undesirable complications. A filtered supply from the Sacramento River was recommended.

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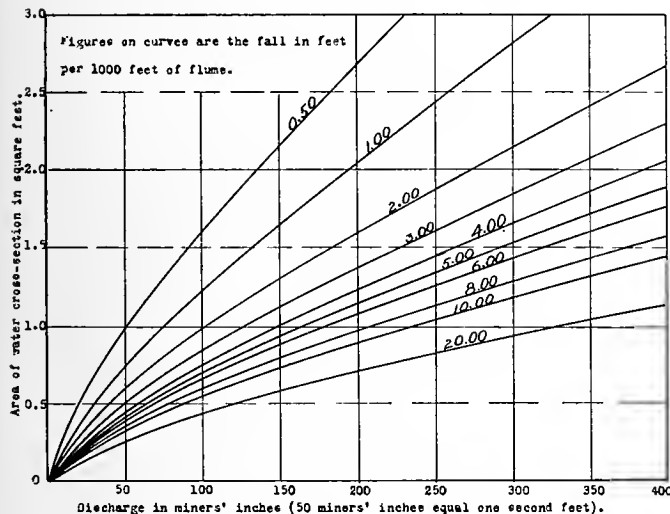


Fig. 4. Carrying Capacity of Small Wooden Flumes in cu. ft. per sec.

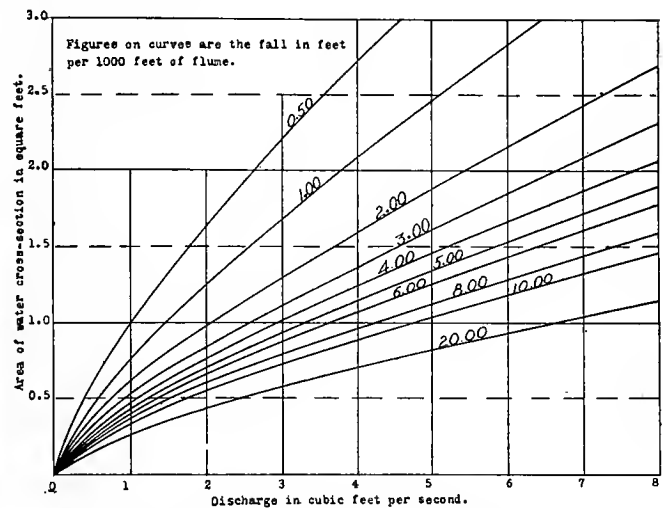


Fig. 5. Carrying Capacity of Small Flumes in Miner's Inches.

DESIGN OF SMALL LINED CANALS.

Lined channels.—Curves for the capacity of wooden flumes are given in Figs. 4, 5 and 6. These are similar to those given for earth ditches. The depth of flow is usually about one-half the bottom width. These curves are based on a value of "n" in Kutter's formula of 0.015. Well built large flumes may have a lower value of n, for farm flumes better capacities are not usual. The carrying capacity of small concrete flumes or lined ditches can also be obtained from these curves as there is usually little difference in the friction factor.

Vertical sided concrete flumes such as are used to distribute water to furrows cost from 20 to 30c per lineal foot. A concrete lining on the bottom and sloping sides of a small earth ditch will cost from 4 to 8 cents per square foot, depending on the thickness and accessibility of materials. Thickness of 1 to 2½ inches would be used in farm practice. These costs are equivalent to 15 to 25 cents per lineal foot for the smallest sizes to 30 to 50 cents for ditches 2 ft. wide on the bottom. Such lined ditches are not used on farms to any extent due to the high first cost and the liability to change in location of field ditches with changes in crops.

Wooden flumes set on the ground are also not usual, although such flumes are frequently used to cross depressions. Where no trestle is required the cost of wooden flumes will be the local price of lumber plus from \$6 to \$8 per M. BM. for labor. This will give usual costs of 10 to 20 cents per lineal foot, depending upon the size. Triangular or V shaped flumes of small capacity may be built for somewhat less.

Crossing depressions.—The previous discussion has been based on channels in evenly sloping land. Where the channel must be supported above the surface as in crossing depressions a wider choice of method is available.

Water can be carried in earth ditches built in fill. Where the bottom of the ditch is more than 2 ft. above the surface of the ground for any distance other

forms of channel for farm ditches are preferable. In many cases flumes would be used for heights of one foot or more. The material required for an earth fill increases nearly as the square of the height. The width of land covered also increases as well as the liability to breaks in the fill.

Wooden or steel flumes or pipe siphons can be used. Flumes are more usual.

The length of ditch required per acre irrigated depends on the method of irrigation used. The controlling factor is the length of run of the water over the land or the distance between ditches. If furrows or checks 660 ft. long are used less than one-half as much field ditch will be required as for runs of 330 ft. Long narrow checks will require less ditch per acre than square checks of equal area. The lengths of ditches required for different sized fields and lengths of run is shown in Table 1. Dividing the length of run by two more than doubles the length of field ditch used due to the supply ditch required along the side of the field. If the topography is such that the ditch can

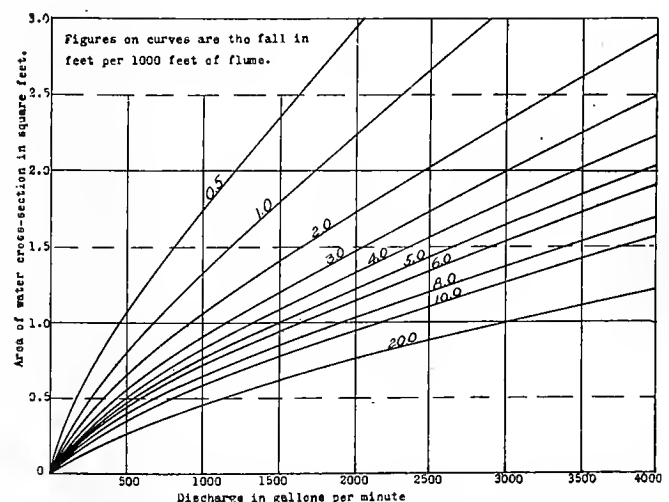


Fig. 6. Carrying Capacity of Small Flumes in Gallons per Minute.

serve checks on both sides the amount of ditch will be reduced by nearly one-half. This usually occurs with rectangular level checks and sometimes with strip checks where there is a ridge in the field.

Table. 1. Length of Ditch Required for Different Length of Checks or Runs.

Length of check in feet.	40 Acre Field.		20 Acre Field. Length down the slope.		20 Acre Field. Length across the slope.	
	Total length of ditch in feet.	Feet per acre.	Total length of ditch in feet.	Feet per acre.	Total length of ditch in feet.	Feet per acre.
1320	1320	33	660	33	.....	...
660	3300	82	1980	99	1320	66
330	6270	157	3620	182	2970	148
220	9020	223	5060	253	4400	220

REPORT ON THE MODESTO IRRIGATION DISTRICT.

The report of the chief engineer of the Modesto Irrigation District covering the recent period of betterment work has just been printed. This report by Mr. F. C. Herrmann gives descriptions and costs of about \$500,000 worth of improvement work carried out from March, 1915, to June, 1916.

At the beginning of the irrigation season of 1915 a comprehensive reconstruction program was undertaken, the actual construction work to be done mainly between the irrigation seasons. A bond issue of \$610,000 was voted. Par value was obtained for \$25,000 of bonds sold to the State Board of Control and the remainder sold at 90.6 per cent of par value.

The new work has been designed for a capacity of 2000 second feet above the Dallas-Warner reservoir and 1200 second feet from the reservoir to the district line.

The time for doing the work was very favorable as material and labor markets were depressed. The district was in a position to make monthly payments in cash. The work was let in contracts of from \$25,000 to \$75,000 with active bidding, good prices being secured by the district.

The distribution of the expenditures was as follows:

Payments to contractors.....	\$382,230
Direct expenditures for construction by district forces....	70,810
Expenditures for rights of way and damages.....	7,110

Total expended for direct construction and rights of way	460,150
Overhead expended for borings, test pits, advertising, engineering and inspection = 7 per cent of total.....	32,510

Total expenditures\$492,660

The overhead expense was 6 per cent on the upper works, 10 per cent on lateral structures and 14 per cent on drainage ditches, an average of 7 per cent on the total cost. The lower overhead cost on the upper works was made possible by the larger units of work handled and the speed with which most of the work was accomplished. The structures within the district consisted of comparatively small units which under a contract basis required relatively high cost of inspection. Overhead on drains has been highest due to the slowness with which the contracts have been handled.

Dry Creek Flume.—The most striking single structure built is the Dry Creek aqueduct or flume. A reinforced concrete flume having a capacity of 1200 second feet is supported on arches in crossing the bed of Dry Creek. The original structure was a wooden flume partly supported by a steel truss. Dry Creek carries large volumes of water at certain times of the

year so that the type of earth fill used on the upper main canal could not be used. The arch type of concrete flume was adopted in order to secure ample waterway.

The main structure is supported by five arches, each having a span of 100 ft. and an approach at either end, the total length of the main structure being 730 ft., including transition and sandbox it has a length of 1100 ft. The abutments on each bank of the stream channel were carried down seven feet below the low water level of Dry Creek and supported by concrete piles, which penetrate into hard compact clay 18 to 27 ft. below the low water level of the creek, thus insuring a safe bearing with freedom from scour.

The flume channel is 18 ft. wide and 9½ ft. deep. The minimum thickness of the walls is 8 in. A three-foot walk is provided at the top of one wall.

At the upstream end a wasteway is provided of sufficient capacity so that the full flow can be turned into Dry Creek. The gates are depressed so that three 5x5 gates can handle 1200 second feet. A wall 3 ft. high extends diagonally upstream across the entrance of the flume, the purpose being to intercept sand deposits which can be sluiced out through the wasteway.

The contract prices were \$14.55 per cubic yard for concrete above the spring line of the arches and \$13.80 per cubic yard below. The price for concrete piles was 75 cents per lineal foot. There were 3361 cubic yards of concrete and 3760 feet of concrete piles. The total contract price was \$62,770. The district expended \$2125 for the gates and miscellaneous work and \$3430 or 5 per cent for borings, advertising, engineering and inspection.

Hydraulic Fills.—The policy of replacing timber flumes by hydraulic fills in creek crossings was continued. About 350,000 cubic yards of material was placed at contract prices varying from 22.8 to 25.5 cents per cubic yard. The total length of flume replaced was about ¾ of a mile. The heights of fill varied from 50 to 100 ft. On the crest of the fills reinforced concrete lined canals designed to support the earth thrust when empty and the water thrust without backfill are built. The channels have a depth of 11 ft., a bottom width of 22 ft. and a top width of 28 ft.

Concrete Lining.—Over 7000 ft. of canal varying from 24 to 40 ft. in bottom width, and from 8 to 11 ft. in depth, with side slopes of 2 to 1 were lined with concrete 2½ in. thick. About 600,000 square feet were placed at a contract price of 6¼ cents per square foot. The contract price on earth excavation was 47 cents and on hardpan, 73 cents per cubic yard.

A number of concrete checks, drops and lateral headgates were built on the distribution system. The contract prices on the reinforced concrete varied from \$11.25 to \$14.75 per cubic yard. On the main canal the prices ranged from \$14 to \$16.50 per cubic yard. A total of about 16,000 cubic yards were placed.

It is expected that the recently organized Waterford Irrigation District will complete arrangements for securing 250 second feet through the Modesto canal. The payment of \$254,000 for this service is expected to complete the capacity to the Dallas-Warner reservoir to 1700 second feet with a capacity of 2000 second feet on all new work.

THE COST OF PROGRESS.

BY LESLIE CRAVEN.

(In this article the author concludes his excellent discussion begun in last week's issue on this important subject relating to the penalties of progress. The author concludes that if a proper development of utility usefulness is to be attained, a realization of a careful and adequate consideration of the risk so peculiarly serious in the electrical industry is absolutely necessary, not only on the part of the utilities, but by the public and its regulatory authorities.—The Editor.)

All authorities, therefore, agree, that the problem of what provision should be made to care for functional depreciation or obsolescence is a problem peculiar to each particular plant. Conditions in each case are so variable that generalities are useless. By a consideration of tens of thousands of individual cases, it may be possible to obtain statistics upon which to calculate the risks of fire and accident insurance, and then by insuring tens of thousands of houses or persons, to collect a fund sufficient to pay the losses. The reliability of such data arises only because of the multitude of instances which are considered in obtaining it. The experience of no such multitude of individual units is available in any study of obsolescence. The experience of other companies in other fields is of little value, excepting in so far as it points to general principles. Deficiencies in the character and size of plants, in the size and nature of loads, in the trend and rapidity of community growth, in the temperament of the people served and of their regulatory agencies, impair the value of any definite statistical information when used in a particular case in another field. The problem is for every company a peculiar problem. Past experience is a guide only in showing that these are risks against which protection should be made, that such rates should be charged that the public will pay the full cost of the service rendered by recompensing the utility for the property thus sacrificed, and that business should be done upon such a margin of profit as to allow the accumulation of a surplus for this protection.

In the past, protection against this risk has received scant consideration among the public utility companies of this part of the country. Business practice has condemned a failure to insure against the danger of loss by fire but there has not been a similar condemnation of the failure to protect investments against the very similar loss arising by virtue of municipal regulation or by virtue of improvement in construction or design. This failure among manufacturing enterprises has occasioned numerous financial disasters where by reason of a false sense of security due to inadequate cost accounting, financial distress has resulted from a failure to maintain the integrity of the investment. Among a large majority of the public utilities there has been a similar failure, though not such financial distress.

The regime has been one laissez faire. There has not been the necessity, therefore, which is now created by regulation, of closely accommodating rates to a fair return upon the present value of the property devoted to public use, nor has there been the necessity of maintaining the close relation between the value of the property and the capital account. The careful

regulation of public utility earnings upon the basis of the value of property devoted to public use has made the present issue an important one. Business was formerly done upon a wider margin and the greater latitude allowed greater opportunity to regain losses from such risks. Adequate systems of cost accounting were not in general use and rate structures bore no close relation to costs of service. No charge was made in operating expenses to cover either physical or functional depreciation. In many companies no particular consideration has been given to the effect of depreciation or obsolescence upon the cost of service because of the general inadequacy or lack of system of cost accounting. Regulation has brought about the necessity for such systems. It has not been the general practice among these companies to write out of the plant accounts the losses of property due to either physical or functional depreciation, nor to accumulate reserves to care for these losses. Often they have been in the developmental period when earnings did not suffice to provide for the accumulation of such funds, and frequently the funds were paid out in the form of dividends, thereby amortizing the capital account. Among some companies it has been thought necessary to show low operating costs and to maintain the book value of the property, in order to facilitate the necessary financing of the enterprises at times when in growing western communities financing has been difficult and frequently necessary.

The dangers of these loose methods of treatment of depreciation have been mitigated, and the financial disaster which might be expected to attend, has been averted, by virtue of the phenomenal increase in the value of the real estate and water rights of the companies operating in this section of the country, the increments in value of those portions of the plant being more than ample to absorb the losses of value arising by virtue of obsolescence and depreciation. In this manner these losses have been regained. The correctness of this conclusion has been frequently demonstrated in recent valuation cases where the relation of the present value of the property to the original investment in the property or to the capitalization or plant account of the utility, has been under investigation.

An examination of the trend of public utility law and of current commission decisions seems to justify the conclusion, that under the system of regulation now prevalent, there should be greater recognition of this risk and its effect upon value, earnings, and cost of service. The public utility acts of many states require that funds shall be accumulated to protect the property against both sorts of depreciation. The Oregon act, for example, requires that: "Rates shall be such as will provide the amounts required above the expense of maintenance to keep such property in a state of efficiency corresponding to the progress of the industry." (Laws of Oregon, 1911, Ch. 279, page 487.) These acts, and the doctrine announced by the Supreme Court in the Knoxville Water Company case require that adequate provision be made. There are equally cogent reasons in the principles of physical valuation. Although these doctrines are yet in a state of flux, the modern tendency of commissions is to

follow the much quoted dicta of Mr. Justice Hughes in the Minnesota Rate Case, (230 U. S. 352), where the court said:

"The basis of calculation is the fair value of the property used for the convenience of the public. What the company is entitled to demand in order that it may have this compensation is a fair return upon the reasonable value of the property at the time of its being used for the public."

Under the doctrine here announced, commissions almost uniformly exclude all property which has been discarded because of obsolescence or inadequacy, or retired because of ordinances or statutes requiring removal, since such property is no longer devoted to the public use.

Thus if a utility has an investment in a unit which, because of functional depreciation, has been retired when only one-half of its natural life has expired, and if depreciation allowances have been accrued on the basis of its natural life rather than the shorter period, and the depreciation allowances are, therefore, sufficient only to amortize one-half of its value, the trend of authority among the commission decisions is not to allow further return upon that property nor to allow the amortization of its value. This means the loss of that part of the investment. This is the result of a logical application of the generally adopted reproduction method in the determination of value for rate making purposes. On the other hand if the utility has properly considered this element of cost and has accumulated replacement annuities which are in a sinking fund, the utility is entitled to a return upon that fund as a part of its property (*Bonbright vs. Geary*, 210 Fed. 44, 52), or if the more probable course is pursued and the funds are invested in additions and enlargements to the plant, these additions will balance retirements and the integrity of the investment will have been maintained. The importance, therefore, in any adjustment of rates, before a commission or on the initiative of the utility itself, of adequate consideration of this element of cost is obvious.

It should be remembered, however, that in any application of the reproduction method, there is considered any appreciation of value. It is sometimes urged that the possibility of such increments is in itself sufficient protection against the risk. There may occur a sufficient advance in the values of the real estate or water rights of the utility to absorb the loss caused by supercession. This has frequently happened among those utilities operating in regions where there has been a sharp advance in commodity or real estate prices. The possibility of these future increments, however, is a speculative contingency upon which conservative management cannot rely as a substitute for replacement funds to maintain the integrity of the investment.

The determination of what is an adequate provision against obsolescence and inadequacy requires study of the individual conditions of the particular plant and its load or traffic as at present and as probable in the future. For the purpose of the calculation of the amount of these annuities such studies are prac-

ticable and although productive of data and information which necessarily, because of the nature of these risks, is neither complete nor adequate, at least may be made the basis of an approximation of what provision should prudently be made in the light of the trend of development of the industry and of the plant, and in light of the probabilities of the losses of the particular plant by reason of that development.

An adequate study of this sort was recently made by Mr. W. G. Vincent, Jr., the valuation engineer of the Pacific Gas & Electric Company, with relation to the San Francisco gas properties of that company in the rate case in the United States District Court in 1914 in which the rates and earnings of the property were in question. In this study he concluded that the physical depreciation of that plant amounted to 2.66 per cent of the depreciable property, and that the functional depreciation in addition amounted to 1.5 per cent. This was based upon a study of the rate of loss during the history of the property and the probable rate of loss of the future.

In any rate case in the determination of what annuities shall be allowed to cover this sort of depreciation, the nature of the risks of the particular plant should be directed to the commission's attention, in order that the amount of revenue allowed to the company shall be adequate to cover the particular risk. This risk of the business is ordinarily covered by the allowance of these annuities. With money at its present cost, in the face of the difficult competition which public utilities must meet in the securing of capital, this risk is not one which is compensated for by the rate of return of from six to eight per cent allowed in current decisions as a fair rate of return upon such investments, particularly, if this rate of return is applied, as frequently it is, to a rate base, which is slightly above the depreciated value of the property.

In this relation attention is called to the fact that the only functional depreciation which is of concern to the utility is that which is greater than the physical depreciation, for it is only when functional depreciation retires the property at an earlier time than physical depreciation demands its retirement, that obsolescence becomes an effective factor and a matter of concern. Otherwise the replacement fund allowed for the retirements due to physical depreciation will suffice. Obviously no provision need be made to cover the risk of obsolescence excepting where it is likely to shorten the life of the units of equipment below the natural life of that equipment as measured by the physical deterioration.

As heretofore suggested, it is a fair deduction from the current authorities that a utility which is able to accrue the funds necessary to make replacements of property and does not do so, in the face of the duty imposed by law, will be deprived in any valuation investigation of that part of the investment, which is lost through functional depreciation and which it fails to so protect. There is no injustice in this rule of law if it is confined to those losses which are due to changes which prudent forethought and careful investigation might anticipate. This generation of the patrons of the utility should not be called

upon to pay, as a part of the costs of the service furnished them, the charge for the use of equipment now obsolete, which was consumed in the service furnished to a previous generation of consumers, and the cost of which was properly chargeable and might have been charged to that generation. But as to losses due to replacements which cannot by any process of study be foreseen, a distinction may be urged. Business conditions, particularly when a utility is in a developmental stage, are frequently such that the revenues of the utility are not sufficient to provide protection. Regulatory practice cannot require the impossible. If losses occur which are not within the range of reasonable anticipation, or occur during times when the business of the utility is in a stage of development in which the market does not justify rates sufficient to allow the setting aside of proper annuities, fair treatment requires that the utility be allowed to earn a return upon the value of the property retired for a sufficient time after its retirement to amortize its value. If such a doctrine is not adopted the hazard of these investments will be very greatly increased, in many cases there will be a practical confiscation of property, and the progress and initiative of the public utility company will be retarded to the detriment of the utility and to the greater detriment of the public.

Retirements due to functional depreciation ordinarily involve improvement of the plant and service. Improvements and obsolescence go hand in hand. Among no business men is there more of a progressive spirit than among the managers of these utilities. In the adoption of regulatory theories in the treatment of the problem, the interests of the public, therefore, necessitate that liberality of treatment which will permit enlightened management in the furnishing of that service, to avail itself of any improvements which the science of the industry affords. Any other course means a penalization of progress. That the utility, where prudent management has been unable to provide from current earnings for the replacement of property retired because of obsolescence, should be allowed to amortize the value of the property after retirement is recognized by the Massachusetts Commission in a recent decision in the rate case of the Marlborough Electric Company, where the court in recognition of the question of public policy which is involved, said:

"It is also of the opinion that one of the important functions of depreciation, beside taking care of the daily wear and tear, is the anticipation of changes in the art and in the possible intervening conditions which, although they may have little or no relation to the useful life of the physical property, yet cannot ordinarily be foreseen. It realizes, however, that a prudent management cannot always have provided fully for changes of this character, and especially in the first stages of the industry, or in a case like this where the business of the earlier years was not profitable. It believes that a proposition to allow the right of the investment to a return, but to disallow in any substantial measure the obligation to keep it good, is not consistent or sound."

The necessity of such treatment of the matter has

been recognized to a limited extent by the state commissions in their promulgation of classifications of accounts. The Oregon classification provides for the amortization of the losses incurred through unanticipated reconstruction which could not be foreseen by the exercise of reasonable prudence. This relief is restricted, however, to improvements required by lawful authority, and does not cover retirements due to ordinary inadequacy or improvements of the art, although these naturally should receive the same consideration.

The treatment of this problem of functional depreciation is one regarding which regulatory theory is not yet crystalized. The theory underlying its determination, like the entire theory of which it is a part, is in the process of growth and evolution. If a proper development is to be attained, a realization of the necessity of a careful and adequate consideration of the risk, so peculiarly serious in the electrical industry, is therefore necessary, not only on the part of the utilities, but by the public and its regulatory authorities.

A REMARKABLE NEW OFFICE BUILDING.

What will be the largest office building in the world built for (and used exclusively by) a single railway company is to be, also, the largest office building in the United States west of Chicago. But perhaps the most unique feature of the monster structure is that it is to be the greatest of all buildings ever erected on the avowedly "home-made" plan. In other words every piece of material going into the building will be a product of California, if possible.

This remarkable structure will be the new building now being erected for the Southern Pacific Company, in San Francisco, to occupy an entire city block on Market street, from Steuart street to Spear street, a distance of 215 feet on Market street, with a depth of 209 ft. to the private street running parallel to Market between it and Mission street.

An idea of the immensity of the new building can be gleaned from the fact that it will have a floor space of half a million square feet, or "standing-room space" for nearly four million human beings, making the new Southern Pacific building so large in floor area that the entire population of the State of California could stand up simultaneously in that one building, should ever the occasion demand. The largest number of piles ever used in any one building in the world will go into the foundation of this building—the exact number being 2285 piles, each 115 ft. high, the tops of which will be fastened together by concrete caps. It will take 20,000 cubic yards of concrete and 500 tons of steel, with bricks to the exact number of 2,500,000. The cost of the building will be \$2,000,000 without fixings. The contract stipulates that the building will be turned over to the Southern Pacific Company on September 15, 1917, the contractors to forfeit \$500 per day for each day of delay, with the company ready to pay the contractors \$500 bonus for every day remaining between date of completion and agreed date of turning over to the railway.

PURCHASING.

BY N. L. MORSE.

(These tips from a purchasing agent should be valuable to all public utility buyers. The paper was presented at the 24th annual convention of the Pacific Coast Gas Association, Santa Barbara, Cal., Sept. 20, 1916. The author is purchasing agent for the Southern California Gas Company of Los Angeles. The Editor.)

A purchasing department is an insurance against excess buying, inferior quality, high prices and poor deliveries.

Modern buying is an actual knowledge of existing methods coupled with a persistent effort to evolve better ones.

Modern buying also means standardizing everything possible, with the result that a large number of purchases are made on standard uniform specifications.

The purchasing department must know:

First: Sources of supply.

Second: Past and estimated future consumption.

Third: Quality.

Fourth: Prices.

Fifth: Intended use of material purchased.

This knowledge is obtained by never-ending study, and so tabulated as to be instantly available. The methods of obtaining this information, are through observation, literature, membership in associations and commercial friendship.

It is advisable for the buyer to visit vendors periodically, noting if their stock is adequate and well kept and checking up their delivery equipment, forming a definite opinion whether they could properly serve him in event of an emergency.

It is also part of the buyer's duties to visit the company warehouse as often as practical, to check the quality of material purchased, as well as arrange for disposition of scrap and obsolete material.

The buyer who makes it a point to see in actual use the material he purchases, possesses a considerable advantage over the one who does not do so.

In literature, the buyer should have standard trade registers, such as, Thomas, MacRea's, Hendrick's, trade papers in his own and allied lines, government publications, the value of which is too often not half realized, weekly bulletins of National Chamber of Commerce and Year Book of American Society for Testing Materials.

The buyer should be a member of trade associations in his own line, the Purchasing Agents' Association, local chamber of commerce and local "ad" club. Commercial friendship is a most vital factor for service. A friendship with all vendors and their representatives should receive intensive cultivation.

The buyer at all times should have with him an auxiliary memo book, showing residence phone numbers of heads of business, to enable him to get in touch with them at night in case of emergency.

The foregoing is a brief outline of necessities in buying, but there are a multitude of things which cannot be tabulated, some of which will be mentioned in the general remarks to follow.

The buyer must maintain a standard of honor and dependability which will merit the respect and attention of the seller.

He must be free from prejudice and willing to

be guided by the results of investigations made by himself and others.

A buyer can never tell when he is going to learn of something valuable to him. He may see some new method in a plant entirely foreign to his line, which may be applied with a considerable saving. An "ad" in a trade paper, a circular in the mail or a scrap of overheard conversation, may result in a yearly saving of thousands of dollars.

The old saying that the "best is the cheapest in the end," does not always apply, for under certain conditions a cheaper article may represent economy, and it is only by seeing the article in use that the buyer can determine what to purchase.

In purchasing, quality, service and price should only be considered in the order mentioned. The saving in first cost is not the point to be sought, but the maximum service for the amount expended.

The advantages of centralized buying have been forcibly brought to public attention in the adoption by seventy-five of our cities of the commission manager plan of government. To illustrate the point, I quote from the first annual report of the City Commission of Dayton, Ohio, dated January 1, 1915, which reads: "Through a standardization of all supplies and materials, and by combining purchases of the various departments and taking advantage of the market conditions, there has been effected a saving of \$33,000 this year over prices paid last year without sacrificing quality."

The fund of good information obtained through combined effort, has never been realized by buyers until recently, the Purchasing Agents' Association being of recent origin. Free illustrated lectures have been given by manufacturers to the Purchasing Agents' Association of Los Angeles, which were very instructive and could have been taken advantage of before, had there been an association to receive them.

Through the local chamber of commerce, the author has located small manufacturers who neither advertise nor employ salesmen, their output being taken exclusively by jobbers. On solicitation, however, they were found willing to supply our requirements at jobbers' prices.

Another function of the buyer is to keep alive competition between the big house and the little fellow, and this calls for diplomacy which the successful purchaser must possess in marked degree.

Some writers argue that personal contact between buyer and seller is no longer necessary. The author takes exception to this, believing that greatest efficiency comes only through mutual helpfulness, and that a friendship with salesmen and heads of business, places the buyer in a position to receive service that could not possibly be obtained any other way.

Large losses are so glaring as to attract attention, which at once stops them. Small losses whose total if allowed to continue would eclipse the aggregate of the large ones, are, generally speaking, stopped through the efforts of the purchasing department.

One more thought in conclusion, namely, efficient buying not only produces lower operating costs, but through the resultant economy in selling expense to the vendor, enables him to quote a lower price than formerly.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

The Russian-American Chamber of Commerce is discussing the question of sending Russian students to North America in order to make them acquainted on the spot with the commercial activity of the United States and its industries.

* * *

The immediate object of teaching the Slavic tongue as conceived by President Suzzallo in a new course to be given at the University of Washington, in Seattle, is to train men in the language necessary for the new trade between the Northwest and Russia.

* * *

New York chemists report that kelp grown in the waters of the Pacific Ocean makes possible an annual supply of potash valued at ninety million dollars and fertilizer nitrates having a value of sixty million dollars. This field of industry will again open up new opportunities for western power companies.

* * *

A movement has been launched by Pacific Coast men to promote commercial and educational relations with the Chinese nation. Julian Arnold, American commercial attache to China and Japan, reports that the Chinese are exceedingly anxious to heighten commercial relationship with America.

* * *

It was recently reported in engineering circles that persons in the employ of the Pacific Gas & Electric Company had gone out armed with Springfield rifles to shoot the California Railroad Commission. Upon investigation the report was found true, the company employes having bested representatives of the Railroad Commission at an exciting contest in target practice.

* * *

Each day draws nearer to the time when our great natural water powers will have wide application for electro-chemical industries. The recent national exposition of the chemical industries held in New York City brought out the interesting fact that today America produces three-fourths of the artificial colors normally required by our textile, paper and other industries, this having taken place since the supply from Germany has been cut off.

* * *

It has been decided by the Commonwealth Government of Australia to appoint a commission to visit the United States to investigate and report upon the methods of manufacture and production in that country and the conditions of employment therein. The commission will consist of six representatives of the manufacturers in Australia, one from each state, together with six representatives of the workers, one also from each state.

* * *

Tokyo papers state that a Japanese professor has invented an incombustible celluloid which can be made from soya-bean cake, and is superior to all others of the kind, in that its cost is only about 20 sen (\$.10) per pound, as compared with the normal cost of \$5

and \$6. It is also stated that a valuable lacquer varnish is obtained as a by-product.

* * *

A competitor to bleaching powder for laundry use, when produced electrolytically or otherwise, has come forward in the chlorinator. This machine may be set up in any laundry and operated from electric service as bleach is needed. It consists essentially of a 50-gallon vat, a 50-gallon stone tank and a soapstone electrolytic cell, with ammeter, thermometer and hydrometer.

* * *

The Sperry searchlight, a recent invention controlled by the U. S. Navy, takes 150 amperes, has a cored positive carbon of only $\frac{5}{8}$ in. in diameter, which is kept in constant rotation and gives out about three and one-half times the light that is projected from the standard carbon used in searchlights. This high intensity searchlight has an intrinsic brilliancy of sixty-five per cent that of the sun when at a thirty degree elevation.

* * *

Turbo air compressors, like steam turbines seem destined to replace the reciprocating type. Single units have been built capable of delivering as high as 60,000 cu. ft. per min. of free air up to a pressure of 170 lb. per sq. in. Turbo-compressors deliver air at practically constant pressure under wide variation in demand, require less floor space, cost less and have a higher over-all efficiency than reciprocating compressors.

* * *

Electricity has characteristics preferable to all other forms of energy. Among these characteristics may be mentioned its high efficiency of generation, the simplicity and efficiency of its transmission, the economy and simplicity of its distribution, the practicability of subdividing it into small units, making possible the generation in large bulk and its application by small consumers and its high efficiency of conversion into other forms of power, especially in small quantities.

* * *

The "cold light" system of Prof. Dussaud, is again being exploded as a novelty in the daily press though its fallacy was exposed some years ago by "The Electrical Review" of London. "The essence of the system is to spin a number of electric lamps on a wheel, each lamp being energized in turn for a fraction of a revolution, so as to give the impression that the light is continuous. As the heat developed whilst the lamp is burning is dissipated whilst it is out, the lamps remain cool—hence the term, "cold light." It is merely a roundabout and elaborate way of obtaining the same result as would be secured by burning one lamp and keeping it cool with a water-jacket or a fan. Whatever advantages are claimed for the Dussaud system can be far more easily and cheaply obtained by other means."

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That the "cost of service" is all wrong as the sole basis for public utility rate-making has long been the opinion of many operators. With some, this disagreement with the ideas of many regulating commissions has become a settled conviction. They feel that the time is at hand when facts should replace theories.

Perhaps the most recent and positive statement of the average commission's ruling is contained in the dissenting opinion of Commissioner Edgerton of California in the Southern California Edison condemnation case at Los Angeles. He italicizes his belief that "a proper rate in a successful public utility business should realize the total cost of service, no more and no less."

This means that a management which is able to show a high cost of service is entitled to a high rate for rendering that service. It places a premium on inefficient and extravagant management. It penalizes progress. Consequently, in the ultimate analysis, it is economically unsound.

Yet a wholly satisfactory substitute has not been found. Some objection has been raised to other proposals which have already been put forward. The theory of a rate based on the value of service, for instance, does not seem, in the opinion of some, to provide sufficient protection to the consumer. To charge all that the traffic will bear savors too much of unregulated monopoly.

Recently, however, some new ideas have been propounded. One of these is found in the decision of the Washington Public Service Commission in the valuation of the Pacific Telephone & Telegraph Company. They define fair value as "the reasonable and necessary detriment a utility suffers in preparation for, and in the service of, its patrons." As this is independent of changing money markets, shifting population and such variables, it gives a more stable foundation for appraisal, a certain fixed and definite amount, constant and easily ascertainable. It is independent of unearned increment and decrement, and other values created by the public.

Another excellent idea is suggested by Mr. Leslie Craven of Portland, Ore., elsewhere in these columns. He emphasizes the importance of a consideration of functional as well as of physical depreciation in arriving at a fair value. His argument may be better understood by the life insurance analogy. Physical depreciation is like death from old age, functional depreciation like death from accident. Insurance against loss from obsolescence and inadequacy is a difficult undertaking because the human mind cannot accurately predict the curve of progress,—inventive and legislative.

While these two ideas differ in several material respects they are alike in requiring recorded facts. In order to ascertain the detriment suffered by a utility in the service of the public, it is necessary to know actual performance based on records. In order to determine the possibility of obsolescence statistics must be available. These records of actual performance and statistics of functional depreciation have seldom been kept. When available they have proven an invaluable aid in arriving at fair values. They

should be of general application referring only to individual cases.

The inference is obvious. Before public utilities can expect that either of these methods, or any others based on facts and not on theory, will be applied by commissions, they must present the figures. Then and then only, will an entirely suitable basis meet with universal agreement.

The unnecessary glare of automobile headlights and other methods of illumination is no more offensive to the eye than are the unnecessary noises of modern life to the ear. Blare is fully as disagreeable and dangerous as glare. Both should

The Elimination of Noise

be obviated.

Effective steps have been taken to protect the eyes of the people but little has been done to protect their ears. The honk of automobiles, the clang of street cars, the whistles of locomotives are all tending to defeat the very purpose of their existence, for their excessive and continuous noise will eventually and inevitably make people hard of hearing.

The complexities of modern civilization have so multiplied noises that they are unbearable to the highly nervous and insidiously wearing down the nerves of the less sensitive. As people awake to this fact strict regulation will be instituted for the suppression of unnecessary noises.

The hospital zones should and will be extended to include all residence districts. Boiler shops and noisy factories will be segregated and every precaution taken to minimize noise in manufacturing and communication. The time is approaching when noise will be tolerated only as a signal of extreme danger.

In the substitution of silent signals for discordant sounds the electric light will play a prominent part. A hint of its possibilities in this direction was given at Portland, Ore., some years ago, when the electric power company announced the results of an election in every home in its system by lamp flashing. Light signals have also been a success in factories where the duties of the workers are in sequence. Many other applications will suggest themselves and thus may efficiency be provided and danger lessened by the elimination of noise.

For some years past governmental and state authorities have published from time to time detailed reports of cost and expenditures encountered in the various reclamation projects that have received either federal or state aid.

Irrigation Reports

Recently a number of privately owned irrigation enterprises have undertaken to do the same thing. The plan is proving to be an excellent one.

Take for instance the recent reports published by the Imperial Water Company No. 1 in Imperial Valley. This report gives unit costs during the year as compared with costs of former years. The Imperial Water Company No. 3 in its recent report goes still further in giving unit costs of structure. Just off the press is another interesting report which is that of the Modesto-Turlock irrigation system.

Such reports setting forth all expenditures in a detailed manner engenders a spirit of confidence not otherwise attainable. But best of all the public at large is thereby enabled to have the benefit of this information which is of most valuable assistance in planning other irrigation systems and in forecasting the cost of operation.

Another feature that is commendable is that of the publishing of the overhead costs. The frank publication of such data quiets gossip and immensely aids in instilling confidence in the management.

And finally its publication demonstrates beyond the question of a doubt that the building, operating and maintaining of vast privately and mutually owned irrigation projects are possible without appealing to governmental aid.

As a whole this open-minded policy of publication unquestionably receives the strong commendation of the users of irrigation systems in particular and the public in general, and it is to be hoped that more and more of the irrigation companies will follow this excellent precedent now so auspiciously established.

Once again western brawn and ingenuity are to triumph in engineering structure. On another page of this issue announcement may be found covering details of construction for the gigantic office building that is being erected in San Francisco at the foot of Market street by the Southern Pacific Company.

Confidence in the West

It is significant that the Southern Pacific Company has such unbounded confidence in California and the West to invest over two millions of dollars in the bare cost of a building without furniture or fixtures.

Looking into other details announced by the management it may also be seen that this building is thus not only to be of record breaking proportions but in addition it is to represent the last word in office building and equipment. For instance an idea of the efficiency details looked after may be gained from the fact that there will be a pneumatic tube mailing system throughout, which will convey papers and telegrams to a central mailing room, there to be re-distributed either between offices in the building or to outside points.

Again one scarcely realizes why a corporation should expend moneys for such enormous office space until he reviews in mind the enormity of the corporation which is undertaking the work. The Southern Pacific Company today employs over fifty thousand people in its operation. In this building over two thousand of these employees will be housed. The pay-roll of this company brings monthly over five millions of dollars to San Francisco and the bay region, while twenty per cent of the taxes paid into the coffers of the state of California come from the holdings of this great corporation, to say nothing of the vast sums of money it contributes to other western states.

Summarizing the proposed structure as a whole it would seem that the management have well-weighed the proper method of interlinking still further their destinies with the people of California and the West. It is needless to remark that this spirit of confidence will not be overlooked by the people.

PERSONALS

W. K. Brown, district manager Crocker-Wheeler Company, is visiting Portland and Seattle.

S. B. Gregory, of the Arrow Electric Company, has returned to San Francisco from the Northwest.

Geo. P. Ey, local auditor of the General Electric Company at Los Angeles, was at San Francisco this week.

C. E. Spaulding, sales manager General Electric Company at Los Angeles, was at San Francisco during the past week.

Llewellyn Evans has succeeded **B. W. Collins**, resigned, as superintendent of the municipal lighting plant at Tacoma, Wash.

R. F. Behan, assistant manager San Francisco office Westinghouse Electric & Manufacturing Company, is taking his annual vacation.

H. S. Perkins, Pacific Coast representative of J. H. Parker, Inc., porcelain manufacturers, left San Francisco for an eastern trip this week.

H. B. Squires, of H. B. Squires & Company, manufacturers' agents at San Francisco, has returned from his vacation at Squaw Camp, Oregon.

W. W. Spangler recently assumed charge of the new branch treasurer's office of the Westinghouse Electric & Manufacturing Company at Seattle.

Samuel Kahn, vice-president and general manager Western States Gas & Electric Company at Stockton, Cal., left this week for a month's trip East.

W. A. Murphy, electrical inspector at Stockton, Cal., has been completely exonerated on charges of unfitness for office recently brought against him by a Stockton contractor.

A. Morbio has resigned as electric vehicle specialist with the Great Western Power Company, to join the sales force of the Kissel Car Company at San Francisco.

Paul A. Shilton, southern manager for R. J. Davis, agent for Century motors and fans, is making an extended tour through Arizona, and will visit the Century factory at St. Louis before his return.

E. B. Strong, president and general manager Journal of Electricity, Power and Gas, left San Francisco this week for an extended eastern trip, in the course of which he will attend the Jovian congress at Indianapolis.

H. M. Crawford, formerly connected with the San Joaquin Light & Power Corporation at Bakersfield, has been appointed sales supervisor for the Pacific Gas & Electric Company in their Marin and Sonoma county districts.

H. F. Yost has been appointed manager of the San Francisco office of the Trumbull Electric Manufacturing Company. Mr. Yost has been connected with the electrical industry on the Coast for years, and has been assistant manager of the San Francisco office for some months past.

Frank Fagan, manager Edison Lamp Works of General Electric Company at San Francisco, has returned from a conference of sales managers and factory superintendents of the company at Association Island. He also attended the convention of the Illuminating Engineering Society.

James E. Barker, electrical and mechanical engineer of Los Angeles, was at San Francisco during the past week in connection with the rehabilitation of the Yuma Water & Electric Company of Yuma, Ariz., which is being operated by the Title Insurance & Trust Company of Los Angeles as trustee.

D. F. McGee of the Electric Bond & Share Company, with headquarters in New York City, is on a tour of inspection of the Utah Power & Light Company's properties. He has recently visited the system of the Western Colorado Power Company and will go from Salt Lake City to the Northwest where his company has extensive interests.

Robt. F. Cooke, chief electrician Trinity Gold Dredging Company, Lewiston, Cal.; **A. B. Creveling**, Pacific Power & Light Company, Walla Walla, Wash.; **Ernest Hinrichs**, Commonwealth Mining & Milling Company, Pearce, Ariz.; **H. S. Jones**, Robbins & Meyers Co., San Francisco; **G. R. Ostermann**, Pacific Gas & Electric Company, Woodland, Cal.; **R. O. Rutherford**, Pacific Telephone & Telegraph Company, Los Angeles; **R. B. Steiert**, Chanslor-Canfield Midway Oil Company, Fellows, Cal.; **Chas. L. Sumner, Jr.**, United Railroads, San Francisco; **Eugene Tays**, Pacific Gas & Electric Company, Benicia, Cal., and **Frederick William Tuck**, Giant Powder Works, Giant, California, have been elected associate members of the American Institute of Electrical Engineers.

MEETING NOTICES.

Great Western Power Company's Picnic.

The company's first annual picnic was held at East Shore Park, Richmond, Cal., September 30, 1916. Nearly 200 enjoyed the company's hospitality and participated in the field sports and dancing. Useful prizes were awarded winners. The most interesting contest was the baseball game between employees of the City Electric Company, San Francisco, and the Great Western Power Company of Oakland, the latter winning by a score of 13 to 7.

Oregon Association Electrical Contractors and Dealers.

The association gave a luncheon at the chamber of commerce September 24th in honor of Albert H. Elliott, W. S. Berry and T. E. Bibbins of San Francisco. Mr. Elliott gave the principal address. The general meeting of the Association was held at the Electric Building on Wednesday evening, September 27th, and it was decided to hold the annual meeting and election of officers on Wednesday evening, October 11th. The principal subject up for discussion was Overhead and Profit and several fine talks were had upon the subject, all going to show that the members are beginning to realize that those two things are essential in successful business.

Oregon Society of Engineers.

The first regular monthly meeting of the Oregon Society of Engineers for this fiscal year was held at the Portland Chamber of Commerce, September 22. The members and their guests first enjoyed a dinner and special phonograph selections, which were donated by Eilers Music Company, after which the regular business of the society was transacted, followed by the speakers of the evening.

The constitutional amendment "regarding the election of new members, making it only necessary for new members to be acceptable to four-fifths of the executive committee instead of having the whole membership vote on the applications for membership."

The president announced that the second issue of the society's Journal would be out in two weeks.

The talk of the evening was on "Ship Building." The first speaker was Mr. Tuttle, of the Northwest Steel Company, who spoke on the steel ship building industry. His company is now building three of the largest and best strictly cargo steamers which will be afloat. They consist of two decks, full poop and forecastle. The crew are housed in the stern of these vessels. Their capacity is 12,330 tons displacement, 425 ft. in length, and 59 ft. beam. It takes 3000 tons of steel to construct them and 800,000 rivets must be driven. The fuel oil is carried in the double bottoms. Speed 10½ knots. Cost, \$1,000,000. The Northwest Steel Company build all of the ship except the machinery, which is built by the Willamette Iron & Steel Company of Portland.

The following method is pursued when a ship is constructed: Preliminary plans and specifications are gotten out and orders placed for material. Then detail plans are made. These are sent to the mould loft and one, two or three sections are made on actual dimensions on the floor of

this shop. Also a body plan is made to represent the ship, and from this plan all floors, frames, beams and all parts of the structure are laid off and templates made and the steel is fabricated from these.

In building a steel ship the hull must be kept as light as possible. These boats are sold on their dead weight capacity. Those ships have 8800 tons dead weight capacity and 7500 tons cargo capacity. His company is adapting its structural steel methods to ship building, and has been very successful as it has had all "fair fits" and have been complimented by the Lloyds' representative.

There are to be built seven of those ships by this concern. At the present time there are 70 building on the Pacific Coast, representing about \$60,000,000 in value.

On the interior construction of the ships Mr. B. C. Ball, of the Willamette Iron & Steel Company, said that reciprocating engines are a thing of the past. Turbines are used universally. All auxiliary machinery is furnished by different specialty companies. In order to determine the horsepower necessary to drive a ship at a given speed, it is the common practice to send the plans and specifications to a testing tank, such as Professor Suddlers at Wisconsin University, and have them find out this value by the law of comparison. This is done by testing an exact model made in wax.

C. W. Steele of the Columbia Engineering Works was the next speaker. His company is going to build single deck, auxiliary type of schooners, equipped with semi-Diesel engines. He stated that he thought that it would take four or five years before the world could turn out enough ships to catch up with normal tonnage, so ship building would be good for that period anyway. The cost of these boats is 45 per cent of steel with a life of 50 per cent of the steel ship, and cost 25 per cent as much to operate. At present charter prices, a ship will pay for itself in one year.

Mr. Fred A. Ballin, naval architect and consulting engineer of Portland, gave a talk covering his 40 years experience. He pointed out how wooden ships were built in Europe and were a work of art. These were the clipper ships of 60 years ago.

To protect the bottoms yellow metal was used as these boats would go on two year voyages. The metal being separated from bottom by felt. The ship being put together with iron. The sea water set up a battery action and soon the whole ship fell apart. Peg construction would not hold. Consequently it became necessary to put the strength in the inside of planking in ships. Ships could only be built in limited size on account of timber limitations. The rules of registry were formulated on this basis. By 1860 wooden ship building died out due to lack of materials in Europe. During 1880-1890 wooden ship building thrived on the Great Lakes, but the timber sizes also limited sizes of ships could not exceed 38 to 40 ft. beam, as the bottom would come up.

He said that wooden ships will outlast steel ships in salt water if the wood is properly treated before construction. Fir wood has no acid and iron was attacked in salt water, though modern steel ships rust out in 25 years.

Naval engineering and architecture did not enter into ship building until steel ships were built, consequently this is another reason why wooden ships were unsatisfactory.

It is Mr. Ballin's opinion that wooden boats with steel for its tension members can be built as long as steel boats. He had the design made complete for one 330 ft. long. He also pointed out that there was not one book published on wooden shipbuilding. The world must be educated that modern ships of large size can be built in the northwest which have longer life than steel ships and cost less to build, as the timber sizes are larger than any place in the world and is free from acids that react in sea water to cause iron to fail. This would establish a permanent industry while the building of single deck auxiliary schooners likely will react and

not be satisfactory as their life and capacity is limited and they can not become a solid investment.

Upon Mr. Ballin's suggestion a resolution was passed by the society to investigate whether or not a course of naval architecture could be established in some of the Oregon educational institutions. The members of the committee were as follows: Messrs. Ballin, Tuttle, Steele, Naramore and Turner. The following members entered into the ship building discussion: Messrs. Stephens, Broili and Henny.

Mr. F. O. Boili read a letter urging upon the society the endorsement of the law before congress to appropriate money to be used in the various land grant colleges for experimental engineering work. This was given the endorsement of the society and the following committee appointed to handle same: Messrs. Rands, Reed, Datan and Steel.

Pacific Coast Electrical Supply Jobbers.

Although the meeting at Hayden Lake, Idaho, September 21 22 and 23, 1916, was held further from San Francisco than any other meeting yet held, the attendance was large. There were many new faces present, especially representatives of jobbing houses from Salt Lake City, Butte, Spokane and Seattle. The following jobbers registered at the hotel:

P. J. Aaron, Fobes Supply Company, Seattle, Wash.
 Harry Byrne, Northcoast Electric Co., Seattle, Wash.
 T. E. Bibbins, Pacific States Electric Co., San Francisco, Cal.
 A. H. Nylen (wife and child), Gilson Elec. Supply Co., Oakland.
 N. W. Graham, Holabird Electric Co., Los Angeles, Cal.
 C. B. Hawley (and wife), Inter-Mountain Electric Co., Salt Lake City, Utah.
 R. S. Pollard, Capital Electric Co., Salt Lake City, Utah.
 H. H. Hoxie, Elec. Ry. & Mfrs. Sup. Co., San Francisco, Cal.
 H. W. Turner (wife and daughter) The Montana Elec. Co., Butte, Mont.
 H. L. Bargion, Washington Elec. Co., Spokane, Wash.
 W. S. Berry, Western Electric Co., San Francisco, Cal.
 D. J. Butts, Western Electric Co., Salt Lake City, Utah.
 J. I. Colwell (wife and child) Western Elec. Co., Seattle, Wash.
 A. S. Moody, Pacific States Elec., Portland, Ore.
 Frank P. Zorn, Pacific States Elec., Seattle, Wash.
 C. C. Hillis (wife and boy) Electric Appliance, San Francisco.
 John A. Ryan, Western Electric Co., Portland, Ore.
 C. M. Will, Fobes Supply Co., Portland, Ore.
 R. J. Dinwoody, Intermountain Elec. Co., Salt Lake City, Utah.
 Albert H. Elliott, Secretary, San Francisco.

In addition the following manufacturers' representatives were present:

H. E. Sanderson, Bryant Electric Co.
 W. C. Wurfel, Westinghouse Lamp Co.
 S. V. Gates, General Electric Co.
 Brewster Hall, Pass & Seymour.
 E. B. Gregory, Arrow Electric Co.
 W. D. McDonald, Westinghouse Elec. & Mfg. Co.
 Carl Wernicke, Westinghouse Electric & Mfg. Co.
 F. G. Larkin, Telephone Electric Equipment Co.
 O. W. Lillard, Gould Storage Battery Co.
 F. G. Beck, American Ever Ready Co.
 J. W. Leighton, American Ever Ready Co.
 A. E. Griswold, A-G. Electric Co.
 Miles Steele, Benjamin Electric Co.
 C. P. Stevens, C. O. Aspinall, G. C. Mandalay

Hayden Lake is a most beautiful body of water, reminding one very much of Lake Tahoe, in California, but it has the advantage of being smaller. Around the lake are many beautiful residences. The fishing is fairly good. Harry Byrne and N. W. Graham, after strenuous labor, brought in a fish, a trout, which they said they caught. After the postmortem was held upon the fish for the purpose of preparing it for the table, it was discovered that the fish was cross-eyed, and the general opinion is that the fish ran into their boat and thus got itself caught.

The usual golf tournament was held. The manufacturers' cup, donated by the jobbers' was won by Miles Steel, with a gross score of 105, his handicap of 10 making 95 net. The Pass & Seymour cup was awarded to J. I. Colwell, 95 gross, 90 net.

A. S. Moody won the jobbers' cup, the Bozanta Tavern cup and a trophy presented by H. W. Turner, with a score of 92 gross and 84 net. The Turner trophy is to be played for by the jobbers, manufacturers and central stations, and will become the property of the one winning it twice in succession or three times.

The golf dinner given by the hotel on Saturday night was unique in that the guests all enjoyed a pheasant dinner.

H. W. Turner acted as toastmaster, and though he modestly disclaimed any particular genius in this line, all present voted him a most model and excellent toastmaster. He called upon C. C. Hillis to present the copper cup to the winner, and this was done in a speech touching upon the history of that old relic. The other cups were presented in fitting speeches and the dinner was voted the usual success.

At the open meeting between the manufacturers and jobbers the subject for discussion was "Slow and Fast Moving Stock." Mr. Bibbins introduced the subject, talking as follows:

"The jobbers were expected to be warehousemen and absorb freight and take care of obsolescence. These elements assume large proportions and it is the old question of a stock problem. This question is little appreciated in the East where jobbers are not compelled to carry large stocks because they are close to manufacturers' stock upon which they draw freely. It is difficult therefore to make an Eastern jobber or manufacturer understand the problem which confronts the jobber on the Coast.

"For example: We knew of an Eastern jobber who carried a limited line of conduit, although he was a large jobber. The Coast jobber packed large stocks and assumed greater burdens. They must carry slow moving stock, for example, 4 in. pipe. The profits are out of all proportion to the expense in some of the scheduled lines where jobbers are remotely situated from manufacturers, and it ought to be the business of the jobber to see that a proper scale of profit is determined upon with respect to the slow moving stock.

Mr. Berry then said: "That the manufacturer was interested in the proposition as much as the jobber. The jobber is trying to cut down his investment by eliminating slow moving items, but if all jobbers cut out slow moving items, the manufacturers would not have stock on the Coast and the jobbers could not do business on the basis of shipments from the East, and the business would thus travel to the manufacturers representatives. If we are compelled to eliminate our stock we will reduce our service."

Mr. Hillis said "the manufacturer sets a high profit on 4 in. stuff because it is slow moving. The jobber is compelled to sell on the same ratio of profit as ½ in. pipe. The manufacturer ought to recognize the difference between fast and slow moving stock and ought to arrange to take care of the jobber on that situation."

Mr. Hawley said that with condulets and special receptacles, the manufacturer takes care of himself. He has forgotten the poor jobber and he forgets this question affects us as it does not affect the jobbers in the East.

The discussion was continued by Messrs. Hall, Steele, Sanderson, Lillard, Gregory and Beck.

California Association of Electrical Contractors and Dealers.

The regular monthly and quarterly meeting was held at Stockton, September 30th, with an attendance of 52 contractors, dealers and jobbers. Various matters of routine business were transacted during the afternoon, including the endorsement of the Society for Electrical Development's plans for "America's Electrical Week," December 2-9.

L. F. Yondall of Stockton, presided at dinner in the evening where the first speaker was President F. J. Somers of San Jose, who reported briefly concerning the Seattle meeting of the Washington Association of Electrical Contractors & Dealers.

E. C. Browne of San Francisco then presented a number of practical suggestions for the guidance of members. He had distributed a form for a universal reminder sheet to prevent mistakes in figuring conduit work. He showed the evil of contractor's giving the customer the whole benefit of advantageous buying on a rising market or in large quantities. He pointed out that estimates on labor cost are apt to be too low because the work is seldom done on a 100 per cent basis and consequently advocated that 20 per cent be

Universal Reminder Sheet for Conduit Work.

Architect Date.....
 Owner.....
 Location.....
 Outlets in Watts. Switches. Receptacles. Drop
 40, 60, 100 SP, DP, 3W, 4W. BF Htr. Sgn. Cords
 Flrs. Hght. 200, 300, 400. Lock Elec. Door.

.....in. Scale.
 Con- Coups. Lock. Con-
 duit. & Ells. Bush dulets Wire

Mains and Feeders.
 Main Light Service.
 Main Power Service.
 Feed.

L. & M. Totals.

Material. Labor.

Ft. ½ in. Conduit (Blk. or Galv.)
 Ft. ¾ in. Conduit (Blk. or Galv.)
 Ft. 1 in. Conduit (Blk. or Galv.)
 Ft. 1 & ¼ Conduit (Blk. or Galv.)
 Ft. 1½ in. Conduit (Blk. or Galv.)
 Ft. in. Conduit (Blk. or Galv.)
 Ft. in. Conduit (Blk. or Galv.)
 Ft. in. Conduit (Blk. or Galv.)
 Ft. in. Conduit (Blk. or Galv.)

Elbows (Blk. or Galv.)
 Coupling (Blk. or Galv.)
 Locknuts.
 Bushings.
 Condulets.

Outlet Boxes and Covers and Studs Complete.
 Switches.
 Drop Cords.
 Receptacles.

Ft. No. 14 S. B. Solid Wire.
 Ft. No. 12 S. B. Solid Wire.
 Ft. No. 10 S. B. Solid Wire.
 Ft. No. 8 S. B. Solid Wire.

Ft. No. 6 D. B. Strnd. Wire.
 Ft. No. D. B. Strnd. Wire.
 Ft. No. D. B. Strnd. Wire.
 Ft. No. D. B. Strnd. Wire.
 Ft. No. D. B. Strnd. Wire.
 Ft. No. D. B. Strnd. Wire.
 Ft. No. D. B. Strnd. Wire.
 Ft. No. D. B. Strnd. Wire.

Fixtures.
 Lamps.
 Panel, Switch and Motor Control Boards.
 Bells and Signals.
 Public Phones.
 Private Phones.
 Clocks.
 Drawings and Incidentals.
 Freight and Cartage.
 R. R. Fare.
 Board and Lodge.
 Superintendence.
 Liability and Compensation Insurance.

added to such estimates. "Slack times are no more an excuse for a ruinously low price than are busy times for an excessively high price." He urged that more attention should be paid to estimating in order to make contracting profitable.

Charles Lyman of Stockton read, with due emphasis, Mr. Gould's paper concerning the local situation at Stockton. This report indicated that great good has been accomplished by the association. G. J. King of Oakland added a few well chosen words of encouragement to the Stockton contractors in their efforts to harmonize conditions, giving especial credit to the example of the San Francisco men.

J. A. Woods of Sacramento stated that the chief aim of the association is to educate its members as to what is a proper profit. He suggested that the process of education be extended to non-members, showing that the education of competitors is essential to the self-preservation of the electrical industry. He emphasized the need for records of cost prices, which should be figured to include the expense of handling and delivering as well as the purchase price. In his opinion the subject of credits and collections has been much neglected, and in conclusion he asked that consideration be given to extending the association field of education.

M. L. Scobey of San Francisco, in commenting on his paper presented at the annual meeting, stated that it had not been his idea to in any way intimate that the non-electrical dealer should be discouraged, but to impress upon the electrical dealer and contractor the fact that he is not getting his full share of the business. He cited minor defects he had observed during the day in Stockton shops,—heating devices at old prices, cluttered display windows insufficient lighting, and the like. He told of the advantage of keeping a store

the San Francisco dealers. They are also trying to induce manufacturers to leave more space on blotters and envelope stuffers for the dealer's imprint as well as to provide for uniform practice in charging for freight on heating devices. The association's newly issued electrical data sheets were shown.

A. H. Halloran of San Francisco explained the purposes of the Society for Electrical Development, told of its signal success in the past and outlined the plans for America's Electrical Week, December 2-9. Practical suggestions were given for tying in and cashing in locally on the Society's national campaign. Special stress was laid on the value of advertising as an accelerator of turnover and a reducer of overhead per unit of sales. The active participation of all present was shown to be the only way to realize the benefits to be gained from the Society's activities.

T. E. Bibbins of San Francisco, after complimenting the association on its strength, briefly outlined the essentials which constitute a successful business man,—integrity, common sense, industry and knowledge. He expressed his sympathy with the efforts of the jobbers, under the spokesman-ship of W. L. Goodwin, to help the contractor. In conclusion he urged the necessity for patience and forbearance in the association's work.

Samuel Taylor of San Francisco told of his satisfaction with the work being accomplished by the association.

W. S. Berry of San Francisco presented evidence of the contractors' improved condition recently, especially as shown by prompter payment of bills. He advised that education of contractors is easier when they are within than when without the association. An increased membership is necessary to provide funds to carry out the aims of the association. The jobber's assistance is always available in solving the contractor's problems.

C. F. Butte of San Francisco succinctly summed up the statements of previous speakers. He stated that the bankers would not take trade acceptances covering labor or material not intended for resale, and for these reasons the contractor could not utilize them. He showed that the approved practice of adding 25 per cent for overhead and 20 per cent for profit really represented only 16 2/3 per cent profit on the business for the year.

W. L. Goodwin of San Francisco emphasized the fact that a job of years cannot be accomplished in a minute. Impatience is not justified because of seemingly slow progress. He advised a close affiliation with the retail hardware men in the future. He told of his own labors in writing a book dealing with the fundamental problem of the electrical industry and how to meet them. Brief description of the trade acceptance and its use was then given. In conclusion, Mr. Goodwin cited as one tangible result of the association's efforts the elimination of competition from the jobber and central station in the sale and installation of apparatus.

H. C. Reid of San Francisco spoke of the advantages of membership in the association, not only in the opportunity to learn new ideas but in actual dividends resulting from putting into practice the association's theory of providing for a substantial profit in all figures.

The assemblage broke up at a late hour, all joining in singing "America," as patriotic electrical Americans. The following were in attendance:

Jefferson W. Asher, Asher Electric Co., San Francisco.
H. Abernethy, Pacific Gas & Electric Co., Oakland.
T. E. Bibbins, Pacific States Electric Co., San Francisco.
W. S. Berry, Western Electric Co., San Francisco.
Tom Bennet, Rex Electric Co. of San Francisco, Oakland.
C. F. Butte, Ecl. & Engineering Co., San Francisco.
E. C. Browne, H. S. Tittle Co., San Francisco.
A. E. Brockway, Latourrette-Fical Co., Sacramento.
C. D. Bass, Commercial Elec. Co.
J. M. Carlson, Central Elec. Co., San Francisco.
E. A. Crowson, Western Electric Co., Oakland.
T. E. Dwyer, Western Electric Co.
T. O. Dowdell, Solano's Supply & Construction Co., Solano.
Geo. G. Drew, Pacific States Electric Co., Oakland.
N. Ellis, Oakland Electric Co., Oakland.
A. F. Flanagan, Elec. Engr. & Supply Co., Stockton.

C. J. Franke, Commercial Electric Co., Stockton.
R. Goold, Goold & Johns, Stockton.
W. L. Goodwin, Pacific States Elec. Co., San Francisco.
C. O. Gould, Gould, The Lightman, Stockton.
Wm. E. Hayes, Santa Rosa.
D. E. Harris, Pacific States Elec. Co., San Francisco.
M. W. Hild, Elec. & Mch. Equip. Co., Stockton.
A. H. Halloran, Journal of Electricity, Power and Gas.
S. Jackson, Berkeley Electric Construction Co., Berkeley.
C. B. Kenney, NePage-McKenny Co., San Francisco.
Robert King, Oakland.
G. J. King, Oakland.
C. T. Lyman, Lyman Elec. Co., Sacramento.
Frank C. Lyman, Lyman Elec. Co., Sacramento.
W. A. Murphy, City Electrician, Stockton.
W. L. Mitick, Conrad Elec. & Motor Co., Oakland.
M. S. Orrick, Western Electric Co., San Francisco.
A. P. Patzer, Patzer's Electrical Works, Stockton.
H. C. Reid, Pacific Fire Extinguisher Co., San Francisco.
H. A. Sayles, Holabird, Reynolds Elec. Co., San Francisco.
C. E. Stanley, Commercial Elec. Co., Stockton.
M. L. Scobey, Home Elec. Co., San Francisco.
H. H. Schultz, Elec. Appliance Co., San Francisco.
Frank J. Somers, San Jose, Cal.
C. V. Schneider, Sacramento, Cal.
Samuel Taylor, Electric Railway & Mfrs. Supply Co., S. F.
C. J. Thelen, Electric Railway & Mfrs. Supply Co., San Francisco.
G. C. Tiffany, Tiffany's, Stockton.
J. A. Woods, Cal. Mech. & Elec. Eng. Co., Sacramento.
L. F. Youdall, Stockton, Cal.

UNITED STATES CIVIL SERVICE EXAMINATION.

The United States Civil Service Commission invites especial attention to the laboratory assistant examination scheduled to be held on October 11-12, 1916. The department states that probably fifteen or more appointments will be made in the Bureau of Standards from this register during the present calendar year. Since an insufficient number of eligibles has been secured from the last two examinations, qualified persons are urged to enter this examination. The entrance salaries of these positions range from \$900 to \$1200 a year.

NEWS OF PORTLAND CONTRACTORS.

F. A. Bauman & Company report that work on the Portland public auditorium is progressing in fine shape.

The Morrison Electric Company has secured the wiring contract for the new United States National Bank building, at Sixth and Stark streets, Portland, Oregon, the amount being \$7500, and also the Vista House, being built upon the Columbia River Highway at Crown Point, amounting to \$750, and report completing the roughing in on the Hawley Pulp & Paper Company's plant at Oregon City which contract was for \$3000.

The Ne Page-McKenny Company secured the contract for the electrical work on the five story tile building on Broadway near Morrison street for Anton Huth.

J. J. Agutter Company has been awarded the electric contract on the new store building for Frederick & Nelson at Seattle, Washington, for the sum of \$42,000.

NEWS OF CALIFORNIA WATER COMMISSION.

The State of California, by S. V. Cortelyou, assistant division engineer of the state highway commission, has applied for permission to appropriate 10 miner's inches of the waters of Salt Creek, tributary to Castiac Creek, for the purpose of highway work in Los Angeles county. A pipe line 18.5 miles long and a small dam and reservoir are parts of the plant required. It is the intention to water about 20 miles of trees on either side of the road. The cost of the works is given in the application at \$30,000.

In the matter of the application of Barclay McCowan of Bakersfield, to appropriate 500 second feet of the waters of Caliente Creek and 100 second feet of the waters of Walker Basin Creek, a tributary, the commission has allowed the applicant until January 1, 1917, to file the necessary maps. Mr. McCowan files his application as trustee of a proposed irrigation district to be formed in Kern county.

The application of L. A. Nares and I. Tellman in the matter of the Pine Flat reservoir and its co-related irrigation project is pending before the commission in connection with granting of rights to the applicants by the federal govern-

ment for the reservoir site. The diversion asked for from the commission is for 1,500,000 miner's inches of 37,500 cubic feet per second of the waters of the Kings River in Fresno county. The point of diversion is given as "the South bank of Kings River, where the north and south center line of Sec. 2, T_p. 13 S., R. 24 E., M. D. M., crosses said river. The system is a combination of the following: Alta, Gould, Fresno, Consolidated People's, Last Chance, Grant, Island, Lemoore, Murphy Slough, Crescent, Stinson, Mendota, West Side, Fish Slough, James Ranch canals. The proposed diversion works include a dam 295 ft. high, 1100 ft. on top and 350 on bottom of concrete. Power developed from reservoir, by a total fall of 100 ft. three miles down the river, is to be used for pumping for irrigation. It is proposed to develop 20,000 theoretical horsepower.

Geo. W. Rice of Bayles, Shasta County, has applied to the commission for permission to appropriate five cubic feet per second of the waters of the north fork of the North Fork of Salt Creek, tributary to the Sacramento River, in Shasta County, for purposes of agriculture.

Frank B. Hoffman of Big Bar, Trinity county, has applied for permission to appropriate 25 cubic feet per second from Rowdy Creek and 8 cubic feet per second from Pelletrau Creek, tributary to Trinity River for agricultural purposes. The water will be conveyed to the lands by a ditch $1\frac{1}{2}$ miles in length and then a pipe line 1000 ft. long, the estimated cost of the works being \$3500.

L. G. Sinnard and Chas. E. Van Barnveld of San Francisco have applied to the state water commission for permission to appropriate for hydraulic purposes, 100 cubic feet per second of the waters of Slate Creek and tributaries, tributary to North Yuba River in Plumas county.

PUBLICATIONS RECEIVED.

"The Flow of Water in Wood-Stave Pipe" is the title of a new professional paper of the U. S. Department of Agriculture, Department Bulletin No. 376, by Fred C. Scobey, irrigation engineer. The bulletin is based upon the results obtained through a large number of experiments on the flow of water in wood-stave pipes ranging from 8 in. to $13\frac{1}{2}$ ft. in diameter. The work also included the collection and analysis of available records of all previous experiments of a similar character. From the results of all experiments made there has been deducted a new set of formulas for the flow of water in stave pipes, which is presented in the bulletin.

SUNBEAM LAMPS IN THE MOVIES.

The electric studio of the Keystone Film Company, at Los Angeles, is 80x120 ft, constructed entirely of reinforced concrete, and was completed six weeks after the first shovel of dirt was removed for the foundation. There are 646 Sunbeam Mazda Photolite lamps used, and work is now being rushed on the remainder of the studio, in which 600 additional Sunbeam lamps will be used. Each bank (side and overhead) carries 9 lamps, and can be tilted at any angle and raised or lowered to any height desired. Each lamp is on an individual circuit and the entire installation is regulated by remote control switches. The installation is the pride of the Los Angeles office of the Western Electric Company, who furnished the equipment.

TRADE NOTES.

Interstate Electric Novelty Company has installed a complete exhibit of Franco products in the display rooms of the San Francisco and Los Angeles Electrical Contractors' Associations.

J. H. Parker, Inc., through Holabird-Reynolds Electric Company, has been awarded the contract for fifty-thousand 4000-volt pin type insulators, ten thousand No. 15 wet process strain insulators and seventy-five hundred No. 504 style wet

process guy-strain insulators for use on the Los Angeles aqueduct power distributing system in outlying districts.

North Bend Lumber Company of Marshfield, Ore., will install an additional 40 h.p. motor which will be served by the Oregon Power Company. Two other mills have started running full time, employing about 125 men. A local shipyard has received contracts for construction of three additional lumber schooners and will install 40 h.p. additional in motors, which will be served by the power company. One hundred and twenty-five horsepower more will be added within a short time.

BOOK REVIEWS.

Principles of the Telephone. By Cyril M. Jansky, B. S., B. A., and Daniel C. Faber, E. E.; 9x5 in.; 160 pp.; 125 illustrations. Published by the McGraw-Hill Book Company, Inc., of New York, and for sale at the Technical Book Shop, San Francisco. Price, \$1.50.

This book constitutes Part I of a series entitled Subscribers' Apparatus, which is being prepared in the extension division of the University of Wisconsin by the authors, who are associate and assistant professors, respectively, in the electrical engineering faculty of the University of Wisconsin. Details of construction are not given to any great extent in the book. Principles that underlie good construction are, nevertheless, clearly set forth. Especial emphasis is placed upon principles of operation of different types of subscribers' apparatus. At the conclusion of each chapter a helpful set of questions is appended. The book is clearly written and well illustrated. It should prove of value to beginners in the study of practical telephony.

Principles of Alternating Current Machinery. By Ralph R. Lawrence; $4\frac{1}{2}$ by 9 in.; 614 pp.; 273 illustrations; cloth binding. Published by McGraw-Hill Book Company, Inc., of New York City, and for sale by the Technical Book Shop, San Francisco. Price \$4.50.

This book deals with the principles underlying the construction and operation of alternating-current machinery. It is in no sense a treatise on design, but is the result of a number of years' teaching experience. The author is associate professor of electrical engineering at the Massachusetts Institute of Technology and Harvard University. The subject matter is treated in the following order; synchronous generators, static transformers, synchronous motors, parallel operation of alternators, synchronous converters, polyphase induction motors, single-phase induction motors, series and repulsion motors. The subject matter is well indexed and the placing of notation symbols at the beginning of the book shows careful planning. The illustrations, of which there are a vast number throughout the volume, are especially clearly drawn. While the book must of necessity deal with severe mathematical treatment, still the written portion of the text is well balanced so that the student is able to absorb mathematical and descriptive matter in almost equal proportions. The book should be welcomed among those interested in the teaching of alternating current machinery.

NEW CATALOGUES.

A list of the publications of the United States Reclamation Service has just been issued and may be obtained by addressing the Secretary of the Department of the Interior at Washington, D. C.

The Crocker-Wheeler Company of Ampere, N. J., has just issued pamphlet on "Motors for Any Application." Bulletin No. 157, on motor applications to printers' machinery, is especially a useful publication for those interested in this line of electrical installation.

A general circular of information covering laws and regulations relating to the reclamation of arid lands by the United States has just been issued by the government and may be obtained by addressing the Secretary of the Department of the Interior at Washington, D. C.



NEWS NOTES



FINANCIAL.

SALT LAKE CITY, UTAH.—The Corinne drainage district in Boxelder county, has received the money for its \$175,000 bond issue, and has let the contract for the largest drainage enterprise in Utah. The bonds were purchased by the Palmer Bond & Mortgage Company of Salt Lake from Chapin A. Day of Ogden, who had a contract with the district for the purchase of the bonds, and who also, through the Corinne Concrete Tile Company, now has the contract for carrying through the work.

SACRAMENTO, CAL.—The reorganization committee of the Northern Electric Company after considerable effort to forestall such an arrangement, has decided to allow foreclosure proceedings to be taken by the holders of the underlying bonds, which are the first mortgage liens, comprising the entire bond issue of the company, amounting to \$3,770,000; first mortgage issue of the Marysville and Colusa Branch Railway, amounting to \$750,000, and the first mortgage bond issue of the Sacramento and Woodland Railway, aggregating \$750,000.

SALT LAKE CITY, UTAH.—The Utah Savings & Trust Company has been appointed transfer agent and the Tracy Loan & Trust Company, a registrar in Salt Lake City for the preferred stock of the Utah Power & Light Company, the principal operating subsidiary of the Utah Securities Company. These appointments were made as a result of the large demand for the preferred stock of the company by employees and customers of the Utah Power & Light Company. Directors and employees of the company in Utah have purchased \$210,000 of the preferred stock and there has been a large amount placed in small lots with customers of the Company. The Utah Light & Power Company and subsidiary companies now have 2424 employees in Utah and the annual payroll for these is in excess of \$1,629,000 a year.

INCORPORATIONS.

ALBANY, ORE.—The Peoples Co-operative Telephone Company has been incorporated here.

ALVADORE, ORE.—Articles of incorporation have been filed for the Alvadore Co-operative Telephone Company.

REDDING, CAL.—The Big Cow Creek Ditch Company has been incorporated with a capital stock of \$5000, by Peter Sieh, E. C. Water, R. D. Knickerbocker, L. H. Parks and F. W. Rogers.

RENO, NEV.—Articles of incorporation have been filed by the Natural Gas & Petroleum Company with a capital stock of \$1,000,000 and shares one dollar each. The main office is located in Reno. The incorporators are Benj. S. Dudley, C. A. Brown, E. R. Dudley, R. V. Dixon and Frank Thomas, all of Oakland.

PHOENIX, ARIZ.—The Walapai Lighting & Power Company has filed articles of incorporation with a capital stock of \$50,000. The officers and directors are: Robert Roe, president; Arthur Fay, vice-president; A. L. Cox, secretary-treasurer. Directors: C. K. Chilberg, Robert Roe, Arthur Fay, A. L. Cox, Wm. Hall.

ILLUMINATION.

CHEWELAH, WASH.—The council has decided to make certain changes in the street lighting system.

DOUGLAS, ARIZ.—The city engineer has completed plans for the proposed new street lighting system.

GARDEN GROVE, CAL.—The subject of better lights for this city is being taken up by the business men's lighting committee.

PORT ANGELES, WASH.—The city council has approved plans for more lights on Lincoln street. The work will cost about \$2000.

FLORENCE, ARIZ.—The city council has approved the granting of an electric light and water franchise to the Douglas Investment Company.

CHICO, CAL.—The city council has passed a resolution, calling for the installation of electroliers in the business district by property owners.

BOZEMAN, MONT.—Robert W. Lysle, representative of Chicago interests, is in the city investigating the prospects for establishing an artificial gas plant here.

RIVERSIDE, CAL.—Permission has been granted the Banning Gas & Lighting Company by the board of supervisors to lay gas pipes along the highway from Banning to Beaumont.

MELSTONE, MONT.—The city council plans an electric lighting plant in connection with the water system. The city will purchase materials and award the contract for installation.

STOCKTON, CAL.—A petition has been presented by residents of Tuxedo Park for the proposed formation of a public highway lighting district. October 20th has been set as the time for hearing protests.

PT. ANGELES, WASH.—Electric light extensions both in street and house lighting will be made to the extent of \$3400. The city clerk has been authorized to advertise for the sale of \$25 000 worth of lighting bonds.

SO. PASADENA, CAL.—A resolution of intention has been adopted by the city trustees for the construction and installation of posts, conduits, wires, etc., along Mission street from Fair Oaks avenue to Prospect avenue.

LOS ANGELES, CAL.—A petition signed by property owners on Washington street between Main and Central avenue asking for the installation of ornamental lights has been presented to the new city council, and referred to the city engineer for checking.

EL PASO, TEXAS.—That the city has definitely decided on a more effective system of lighting the streets, has been announced by Mayor Lea. A test light has been in operation for some time at Rio Grande and Virginia streets and that is the type of light which will be installed.

HANFORD, CAL.—The Central California Gas Company is negotiating for the purchase of the plant of the Hanford Gas & Power Company. The deal, if consummated, would mean an extension of the system to Lemoore, adding about 40 per cent to the service of the Visalia generating plant, which is shortly to be doubled in size.

TRANSMISSION.

TACOMA, WASH.—The Tacoma Railway & Power Company will repair its car barn at South Thirteenth and A streets by day labor at a cost of \$6500.

TACOMA, WASH.—Twenty-five thousand dollars will be expended by the city council for beautifying the city's power plant and building five cottages for employees, etc.

STANWOOD, WASH.—Washington Coast Utilities Company, E. G. Robinson, representative, has petitioned the council here for the right to make changes and improvements.

LOS ANGELES, CAL.—The Southern California Edison Company has awarded the contract to E. D. Tyler for the erection of a frame and plaster substation on Huntington Drive.

VANCOUVER, WASH.—The Portland Railway, Light & Power Company was awarded a franchise for operating its

cars over the new interstate bridge here on the Pacific Highway.

SALEM, ORE.—The state engineer has issued a permit to the city of Myrtle Creek to appropriate 150 second feet of the waters of South Umpqua River for the purpose of developing electricity. The estimated cost of the plant is \$30,000.

REDDING, CAL.—The T. H. Benton ranch of 1100 acres on Battle Creek has been purchased by the Northern California Power Company. The ranch carries with it the three important water rights from Digger Creek, Bailey Creek and Battle Creek.

BILLINGS, MONT.—Construction of a branch line 35 miles long from Hesper, on the Great Northern, to the heart of the Lake Basin country, 50 miles northeast of Billings, has been decided upon by the Northern Pacific Railway Company. Work will start in the near future.

BANDON, ORE.—The Bandon Light & Power Company has concluded preliminary negotiations with the Oregon Power Company which may result in the sale of their holdings to that organization and the outcome an extension of the service.

ALAMEDA, CAL.—City Attorney A. F. St. Sure has filed an opinion with the city council holding that the Great Western Power Company is now delivering electrical current to the Union Iron Works, contrary to the provision of the city charter. Steps will be taken to force the company to obtain a franchise or cease to operate in the city.

GREENVILLE, CAL.—The Great Western Power Company has several surveying parties in the field between Lake Amador near Prattville, and the proposed plant at Belden. These parties are selecting the most feasible line for the tunnel and canals that are to connect the lake with the proposed plant at the mouth of Butt Creek.

BANDON, ORE.—Negotiations are under way by the Oregon Power Company to extend its transmission line from Coquille to Bandon, a distance of approximately 28 miles, furnishing electricity for this city and all intervening points, including the coal mines at Riverton, the towns of Riverton, Lampa, Parkersburg and Prosper, all of which are on the Coquille River.

LOS ANGELES, CAL.—It is announced by Mayor Woodman that he will call a conference with the water board and the public service commission to arrive at a decision regarding the purchase or construction of a power distributing system. The mayor is in favor of purchasing the distributing system at a reasonable price, but if this cannot be done, he is in favor of building a new system.

SALT LAKE CITY, UTAH.—The ninety mile extension of the Utah Power & Light Company's transmission system to the coal fields in Carbon County, Utah, has been completed and service on the line was inaugurated September 28th. The company is now serving the coal properties of the Carbon County Fuel Company and the United States Fuel Company. Other coal operators in this section will be ready to use service in the near future.

ASTORIA, ORE.—After a controversy extending over a period of several weeks, an amicable agreement has been reached between the city council and the public service corporations, whereby all the electric wires in the district where the streets are being improved with a viaduct system are to be placed underneath the pavement. The overhead wires in other portions of the business district are to be rebuilt and a strictly modern system installed.

SACRAMENTO, CAL.—The jury in the condemnation case of the Pacific Gas & Electric Company against George Shearman and Benjamin F. Biggs for a right of way for a power line, rendered a verdict for the defendants in the sum of \$5415, and \$350 for the purchase of the land that is to be actually used for the right of way. The defendants valued their land, which is located near White Rock, at \$150 an acre and placed the damage on over 1000 acres of ground.

The company placed the value of the land in question at \$15 an acre for grazing purposes.

TRANSPORTATION.

EL PASO, TEX.—A petition by the El Paso Electric Railway Company to place wires underground in the downtown district is being considered by the city council.

SANTA ANA, CAL.—Rebuilding of the Pacific Electric tracks on Fourth street between Flower and Lacy streets, with repaving of the right-of-way is promised by officials of the road for the near future.

TELEPHONE AND TELEGRAPH.

TOWNSEND, MONT.—J. B. Seeley, supervisor Helena National Forest, plans a line from this place to Smith River Valley, 16 miles long.

PHOENIX, ARIZ.—A private exchange is being installed by the Mountain States Telephone Company for the Pacific Creamery plant east of Tempe.

BEND, ORE.—The Pacific States Telephone Company is planning extensions to its present system in Bend and vicinity which will cost about \$12,000.

SPOKANE WASH.—The Pacific Telephone & Telegraph Company contemplates improvements aggregating \$26,760 in value. Of this amount \$9710 will be spent in Spokane.

SAN BERNARDINO, CAL.—C. C. Coop, general manager of the Postal Telegraph Company of the Los Angeles and San Diego district, has arrived here with a force of men to begin rebuilding the lines which center here. The local office will be equipped with additional wires.

DUNCAN, ARIZ.—A change was made in the ownership of the Duncan telephone system when E. M. Luckie purchased the half interest in the property owned by James V. Parks. The system is now owned by J. F. Allen and E. M. Luckie, and they are planning to make improvements in the equipment and service in the near future.

LA GRANDE, ORE.—Preliminary to minor rate adjustments of the Home Independent Telephone Company, the public service commission has completed a survey of that company's plant here and over the entire system. Engineer Busselle, of Salem, estimates the value of the La Grande exchange at \$115,000. Figures for a reproduction of the whole system were placed at nearly \$300,000.

IRRIGATION.

SUSANVILLE, CAL.—Residents of Long Valley Creek have petitioned the Lassen County Board of Supervisors for the formation of an irrigation district.

SALEM, ORE.—R. W. Rea, chief engineer for the Ochoco irrigation district has asked State Engineer Lewis to approve plans of the district for holding an election for the issuance of \$1,000,000 in bonds. The district was organized on February for the irrigation of 23,400 acres of land situated near Prineville.

TERRA BELLA, CAL.—At a meeting of the directors of the Terra Bella Irrigation District contracts were awarded for the drilling of six deep wells to be put down on optioned land west of the Southern Pacific tracks. The district will probably advertise for bids for the construction of the first unit of the irrigation system and for the sale of the bonds before the six wells now contracted for are finished.

SACRAMENTO, CAL.—The Landis Bros. Company of San Francisco has filed an application with the state water commission to appropriate 100,000 acre feet per annum of the waters of Dry Creek, the enterprise to be known as the Dry Creek Irrigation Project. According to the plans submitted to the commission, construction will begin not later than September 1, 1917, on a diversion dam 60 ft. in height, 1400 ft. long on top and 1200 on the bottom. All told, 100,000 acres will be included in the project.

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Rotary Flush.

List.	Sell.
S. P., without plate62
S. P., without plate71
D. P., without plate	1.05
3-Way, without plate	1.05
3-Way, without plate . . . . .	.82
4-Way, without plate	1.05
3-Section Electrolier, without plate	1.05
2-Section Electrolier, without plate	1.05

Switches—Special Push Button.

Single Pole	1.08
Double Pole	1.33
3-Way	1.33
4-Way	3.00
Momentary	3.50
Remote Control Switchplates	3.00

Removable Mech.

D. P., without plate	1.20
S. P., without plate . . . . .	.84
3-Way, without plate	1.20
4-Way, without plate	1.20
S. P. Lock, without plate	1.34
D. P. Lock, without plate	1.70

Pendant.

6-Amp. S. P. . . . .	.50
10-Amp. S. P. . . . .	.80
6-Amp. S. P., Straight Thru . . . . .	.60
10-Amp. D. P., Straight Thru	1.20

Pull.

10 A., S. P.	1.00
10 A., 3-Way	1.18
5 A., 4-Point	1.18
5 A., Electrolier, 2 and 3 Circuit	1.18
10 A., D. P.	1.18

Snap.

5 Amp., S. P. . . . .	.28
5 Amp., S. P. Ind. . . . .	.32
10 Amp., S. P. . . . .	.48
10 Amp., S. P. Ind. . . . .	.54
3 Amp., 3-Way . . . . .	.48
5 Amp., 3-Way . . . . .	.56
10 Amp., 3-Way . . . . .	.76
5 Amp., 4-Way . . . . .	.86
5 Amp. 2-Circuit Electrolier . . . . .	.76
5 Amp. 3-Circuit Electrolier . . . . .	.76
5 Amp., D. P. . . . .	.56
10 Amp. D. P. . . . .	.66

Canopy.

3 Amp. Spun Canopy . . . . .	.75
3 Amp. Cast Canopy . . . . .	.80

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

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Straps—Tinned Pipe

List.	Sell.
1/2—20 per lb.25
3/4—19 per lb.25
1—16 per lb.25
1 1/4—13 per lb.25
1 1/2—11 per lb. . . . .	.25
2—9 per lb. . . . .	.25
2 1/2—5 per lb. . . . .	.25
3—4 per lb. . . . .	.25

Half Pipe Straps.

Per 100	Per 100
1/2-inch	1.50
3/4-inch	1.67
1 1/16-inch	3.34
3/4-inch	3.75
1-inch	4.25
1 1/8-inch	4.34
1 1/4-inch	5.10
1 1/2-inch	5.10
1 3/4-inch	5.34
2-inch	5.34

Fixture Studs.

3/8-inch, per 100	5.00
1/2-inch, per 100	6.50

Speaking Tube.

Speaking Tube, per foot . . . . .	.02 1/2
Elbows . . . . .	.03
Mouthpiece, plain . . . . .	.11
Whistles . . . . .	.33
Flexible Tube, per foot . . . . .	.31
Flexible Terminals, 2 ft., complete	1.50
Tube Rack . . . . .	.30
Tee . . . . .	.14

Switches—Flush.

S. P., without plate . . . . .	.45
D. P., without plate	1.05
3-Way, without plate . . . . .	.70
4-Way, without plate	2.00

Flush Lock Push Button.

S. P. Lock, without plate	1.06
D. P. Lock, without plate	1.30
3-Way Lock, without plate	1.30
4-Way Lock, without plate	2.50
Key for Lock Push Button Switch . . . . .	.15
Lock Attachment . . . . .	.16

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

- | | |
|---|---|
| A-1 American Ever-Ready Works of National Carbon Co.
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-4 Morse Chain Company..... 6
Monadnock Bldg., San Francisco. |
| B-1 Baker-Joslyn Company..... 3
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco. | N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco. |
| C-1 Century Electric Co..... 2
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore. | N-3 National Lamp Works of G. E. Co..... 3
(All Jobbers.) |
| C-3 Crocker-Wheeler Co.....
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles. | N-4 New York Insulated Wire Co..... 3
629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles. | N-6 National Carbon Co..... 12
Cleveland, Ohio. |
| D-4 Davis Slate & Manufacturing Co.....
Chicago, Ill. | O-1 Okonite Co. (The)..... 12
(All Jobbers.) |
| D-2 Dearborn Chemical Company..... 11
355 East Second St., Los Angeles; 301 Front St., San Francisco. | P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle. |
| E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles. | P-4 Pelton Water Wheel Co..... 11
2219 Harrison St., San Francisco. |
| E-2 Edison Storage Battery Co..... 11
206-8-10 First St., (near Howard), San Francisco. | P-5 Pierson, Roeding & Co..... 4
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle. |
| E-3 Electric Agencies Co.....
279-283 Minna St., San Francisco; 419-421 E. Third St., Los Angeles. | P-7 Pittsburgh Piping & Equipment Co..... 12
Monadnock Bldg., San Francisco. |
| E-4 Electric Storage Battery Co.....
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| F-3 Federal Sign System (Electric).....
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Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives. |
| G-1 General Electric Co..... 10
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Pawtucket, R. I. |
| H-1 Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.) | U-1 United Sheet Metal Works.....
575 Howard St., San Francisco. |
| H-2 Hemingray Glass Co..... 11
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261-263 So. Los Angeles St., Los Angeles. | W-4 Westinghouse Electric & Manufacturing Co.....
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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, OCTOBER 14, 1916

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SOLVED.

BY A. J. KERCHER.

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PACIFIC GAS & ELECTRIC CO.'S SYSTEM.

BY F. C. PIATT.

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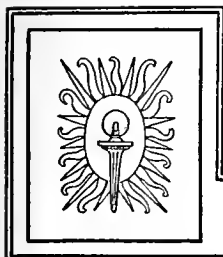
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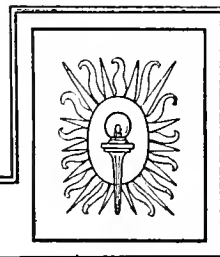
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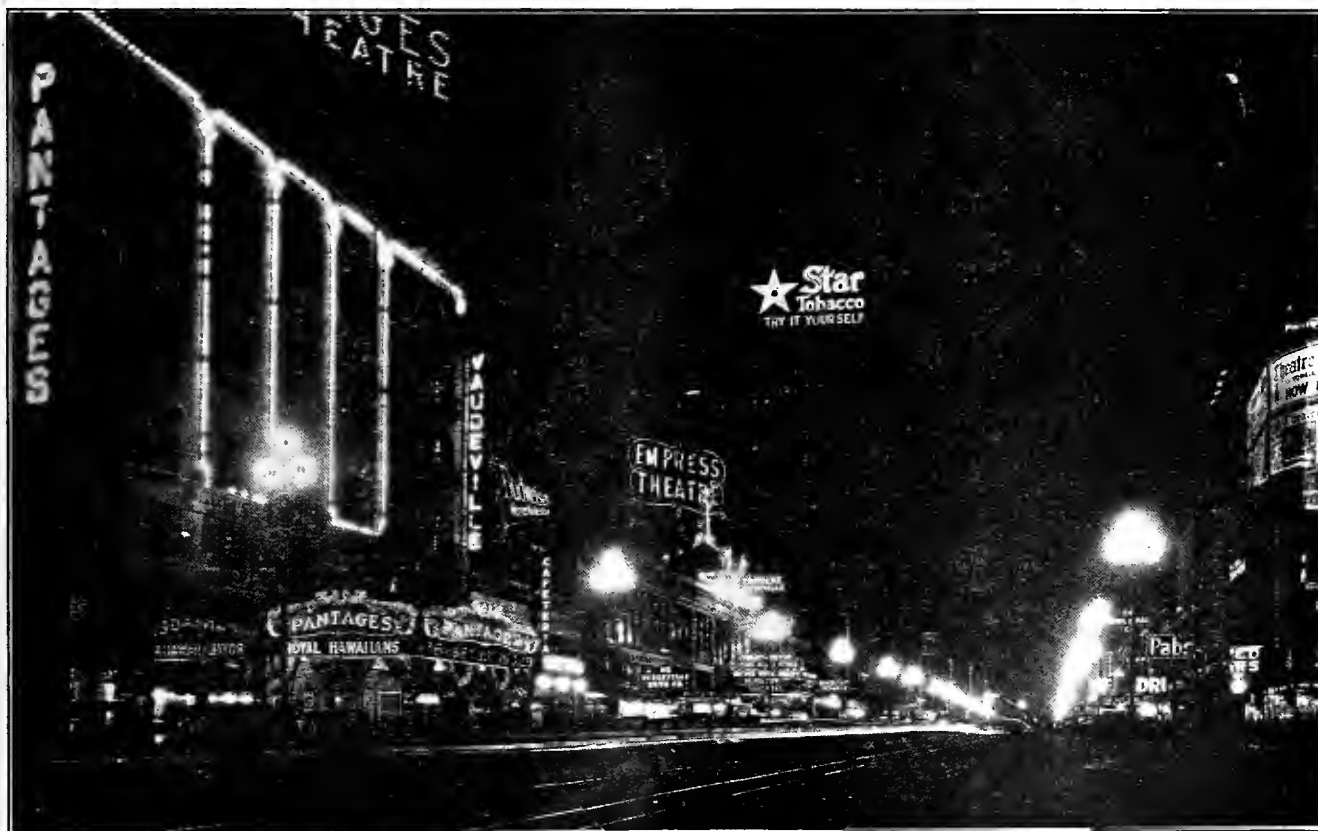
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SAN FRANCISCO'S PATH OF GOLD

San Francisco celebrated its advent as having the best illuminated street in America as its main artery by means of a great pageant on the night of October 4th. Then, for the first time, the new system of luminous arc lamps on ornamental standards showed the architectural beauty of Market street by night.

daily press as the following extract from the Chronicle:

"A warm white light, the most brilliant that ever shone through a city thoroughfare after the sun had gone down, flooded the canyon of Market street from the Ferry to Seventh street. In this high tide of light the stars disappeared, the facades of buildings, never



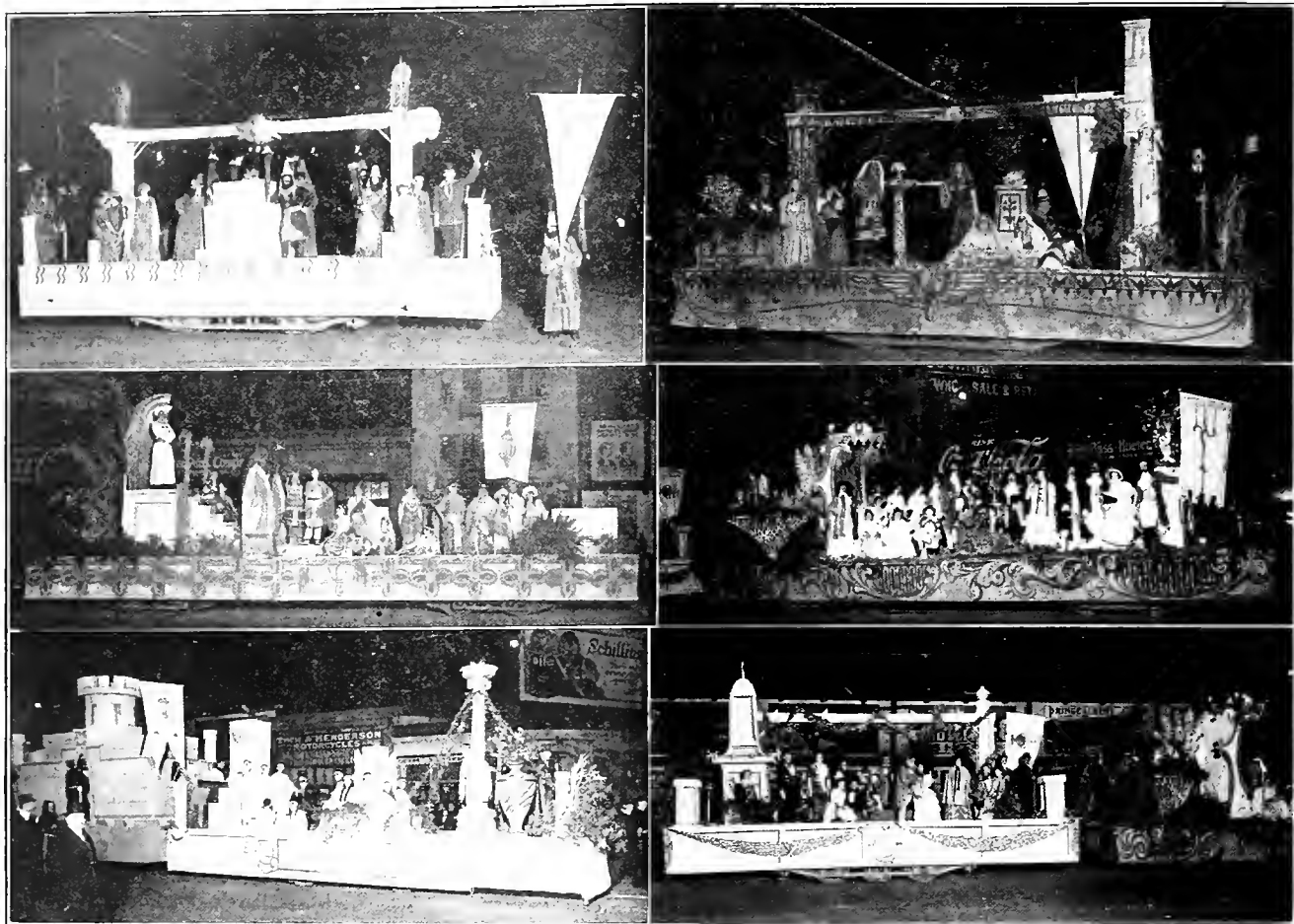
Market Street, San Francisco, as the Path of Gold.

The accompanying pictures give a faint idea of the effect obtained.

As the full details of the lighting methods employed and of the floats participating in the parade were published in this journal of September 9, 1916, there is but little more to add. The illumination and electrical pageant were witnessed by the largest crowds that ever assembled on the streets of the city at night, and on every side were expressions of satisfaction and delight concerning its appearance. These may be typified as descriptions of the effect from the

really seen before, stood out sharp against the night above. The banners waving midway in the night breeze glowed with color as though they had become luminous. On the sidewalks and the pavements light flowed everywhere, touched and enveloped everything, became all-pervading, as though it was rather a quality of the atmosphere than an illumination proceeding from any fixed source.

"Such was the wizardry of this marvelous light. It filled the street completely. It flowed into every space, as though it were a fluid standing in the trough of



Floats illustrating the Evolution of Light.

Market street. In comparison with the brilliant illumination on Market street, every other street intersecting it seemed but a byway leading into darkness."

The Examiner characterized the illuminated thoroughfare as a "fairy street." "Out of the night flashed a new brilliance. The magic lamp of Aladdin became multiplied ten thousand fold. His wishing carpet lay the length of market street from the place where the ships come in to within a stone's throw of another realized vision, the Civic Center."

The warmest encomiums were showered upon W. D'A. Ryan, the illuminating engineer who wrought the wizardry.

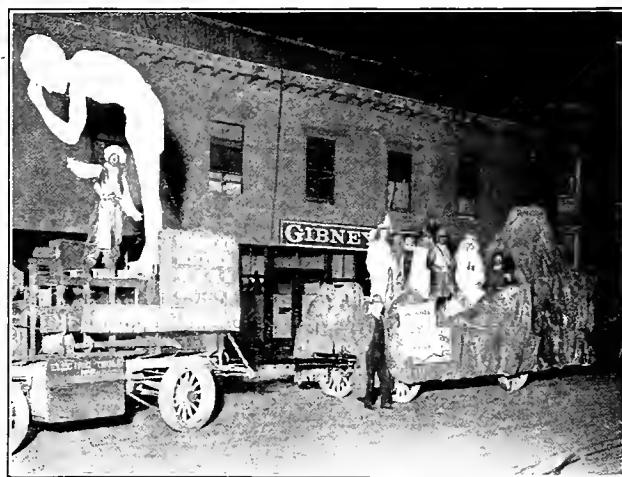
The pageant was in three divisions. It was headed by various civic, military and fraternal organizations. Then came the electrical section, and lastly came the wonderful street car floats symbolizing the progress of man as represented by the evolution of lighting through the ages.

The first float in the electrical division, of which T. E. Collins and E. A. Wilcox were marshals, was that of the Electrical Development and Jovian League. It consisted of an animated replica of the "Modern Aladdin" poster mounted on an electric truck, which hauled a great smoking volcano on which appeared the Jovian team in costume.

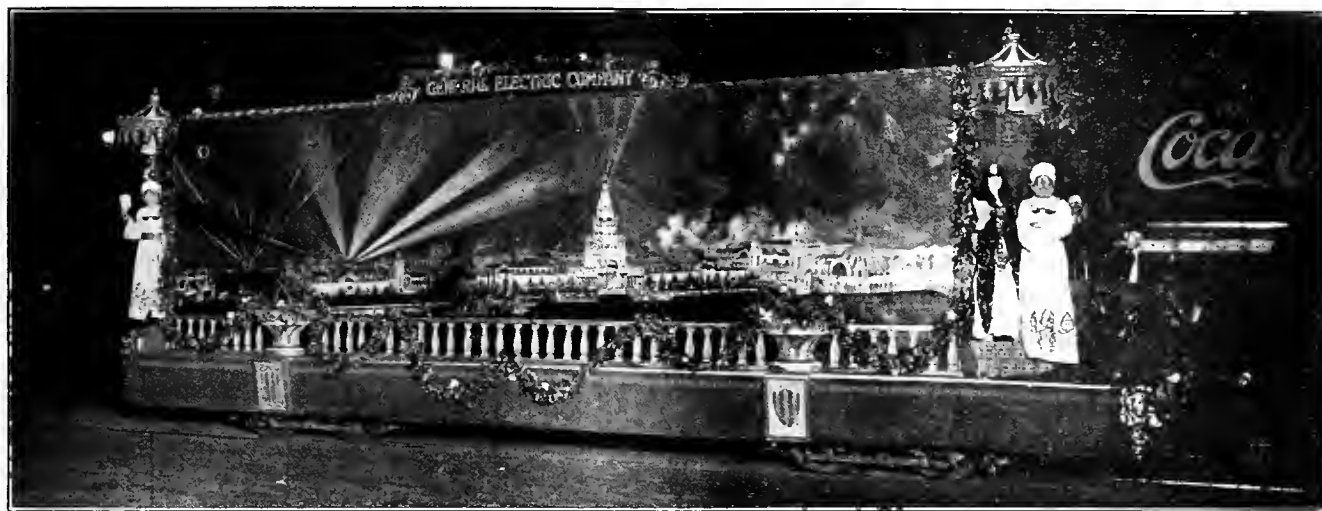
The Aladdin poster was brought to life by a lad



Flood Lighting of City Hall Dome.



Electrical Development and Jovian League Float.



Float Showing Exposition by Night.

in Oriental costume and a great 18-foot genie. Electric lighted transparencies on either side carried the message "America's Electrical Week, Dec. 2-9, 1916. Do It Electrically." Aladdin was a Chinese boy. The genie was made of board, cut in silhouette and painted in colors. Current for the lamps was obtained from the truck's batteries.

The volcano was 24 ft. long, 8 ft. wide and 12 ft. at the highest point. On it the Jovians disported themselves with red and green fire and blazing torches. Under the direction of Tribune Murray Orrick were the following characters:

Jupiter.....A. E. Drendell	Mars.....H. E. Bittman
Neptune.....H. P. Treat	Hercules.....W. C. Wurfell
Vulcan.....Horace Case	Apollo.....Wm. Neelands
Pluto.....George Gray	Mercury.....A. J. Calloway

Particular credit is due to the Western Electric men for their hearty co-operation in the plan, half of the team coming from the one company.

Other floats in the electrical section included those of the American Ever Ready Company, the Novelty Electric Sign Company's electric flag and the "Cat's Paw" illuminated float.

The most elaborate floats were those in the last division showing the lights of all ages. These included "The Cave Man," with burning pine knot; "Assyrian," with torch and clay lamp; "Egyptian," with lamp and brazier; "Grecian," with decorated bronze lamp; "Roman," with candelabra; "Middle Ages," with candle, lantern and braziers; "Italian Renaissance," with festooned oil cups; "Eighteenth Century French," with hand lanterns and wall brackets; "Period of 1850," with early gas fixture; "Period of 1870," with oil lamp and calcium lamp; "Athena of the Heavens," Goddess of Light, representing the arc; "Mazda," the God of Light, representing the incandescent; "Modern Electric Lighting," "The Exposition by Night."

The Ferry tower was specially lighted in colored outline and the City Hall dome was illuminated by flood lighting as shown in illustration herewith.

On Thursday evening, October 5th, the festivities were concluded with a masque ball in the Exposition Auditorium, which was decorated in accordance with designs furnished by Mr. Ryan. Dahlias and chrysan-

themums, in tall vases, on the pillars that rose from the boxes, formed a garden wall about the variegated hues of the dance floors, and each cluster of flowers bloomed in its own bright ray of light, while in the center of the hall arose a tower of flowers, lighted by the scintillators from the gallery.

Throughout the evening special effects were staged on the floor, chief of which was the Pageant of Light, in which 300 young men and young women in beautiful and effective garb represented the evolution of illu-



A Typical Path of Gold Standard.

mination, from the cave man, with his flickering torch, through the advance of Greece and Rome, the Middle Ages and Renaissance to the modern days of electricity, and the final success of outdoor lighting in the Path of Gold on Market street, the permanent and tangible relic of the wonderful illumination of the Panama-Pacific International Exposition.

SOME ELECTRIC WATER-HEATING PROBLEMS SOLVED.

BY A. J. KERCHER.

Every engineer and physicist, who has investigated electrical service as applied to heating water, is conversant with its limitations, the most important of which, from the standpoint of the consumer, is the cost of service and from the central station standpoint, the load and diversity factors encountered.

The quantity of heat necessary to increase the temperature of a unit of water to any predetermined point is always the same, and the efficiency of water heating apparatus depends entirely on the percentage of heat transferred from a resistor to the water. The efficiency of water heating service, however, introduces the problem, not only of an efficient heating device, but the conservation of the heat. Current demand and diversity factor also enter into the problem and in many cases determine the rate for service. The maximum water demand is all important and in the case of domestic service, is usually on a weekly cycle.

In numerous instances it has been demonstrated that hot water service can be furnished by electricity in apparatus designed for a low current demand and high service efficiency cheaper than by other methods.

It is well known that the electric light and electric motor superseded the use of oil or gas in the first instance, and gas or steam power in the other, because the service either cost less or was better. The same reasoning applies to electric water heating.

A large number of office buildings and residences built a few years ago are without hot water service. These buildings are of Class A, or modern construction and yet without the modern system of electric ducts for power service. Today hot water is considered an essential service in any first class office building or home.

To meet the requirements of these conditions which call for apparatus justifying a low rate for service, with a small minimum charge and without added expense of extra wiring, special water heating apparatus has been designed. It can be built in sizes to suit the maximum demand for hot water while the current demand depending on the water demand and size of storage tank is very low.

Description and Test.

A standard lavatory water heater as shown in Fig. 1, designed to be placed either above the bowl or below it, is constructed as follows:

A cylinder with hemispherical heads welded into each end (1) is completely surrounded by thermal insulating material (2) which is protected by a polished metal case (3); the heating element (4) is clamped around a groove rolled into the copper tank. A cylinder (5) is suspended in the position illustrated to provide a restricted circulation of water so that hot water will be available sooner at the top of the tank. The hot water pipe (6) is returned to the lower level of the tank in order to prevent loss of heat by convection during the time when water is not being used. The cold water inlet (7) is placed in the bottom head and water is admitted directly over the pressure cell (8) which opens the switch contacts (9) when the

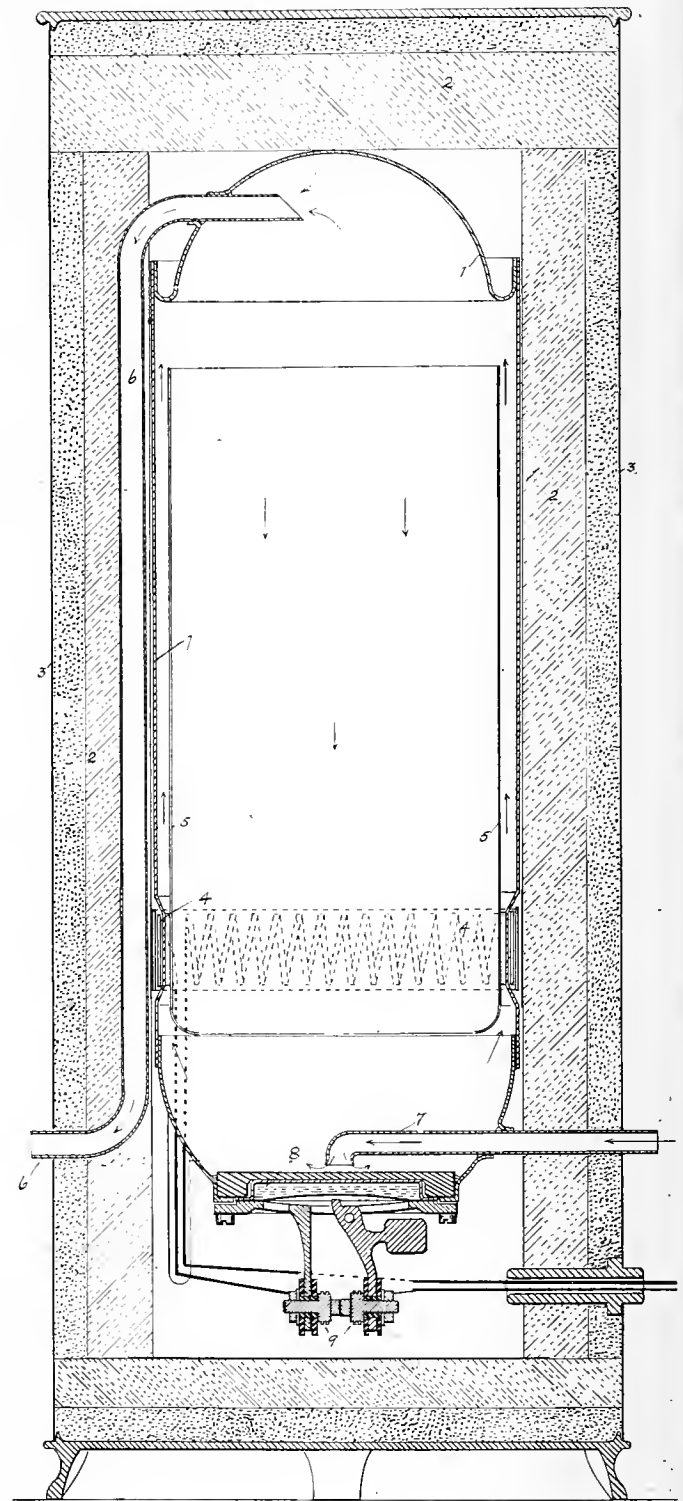


Fig. 1. An Automatic Lavatory Type of Water Heater.

temperature of the water reaches a predetermined point. Should any water be drawn from the tank, cold water will immediately cause the switch to close.

A test of the above heater which shows the practicability of electric water heating in a large office is as follows:

A 2 gal. 600 watt standard lavatory heater was installed with a water meter in the cold water supply pipe. A watt hour meter and a recording ammeter were used to measure the current input.

No restrictions were placed on the use of hot water, which was used only during the usual office

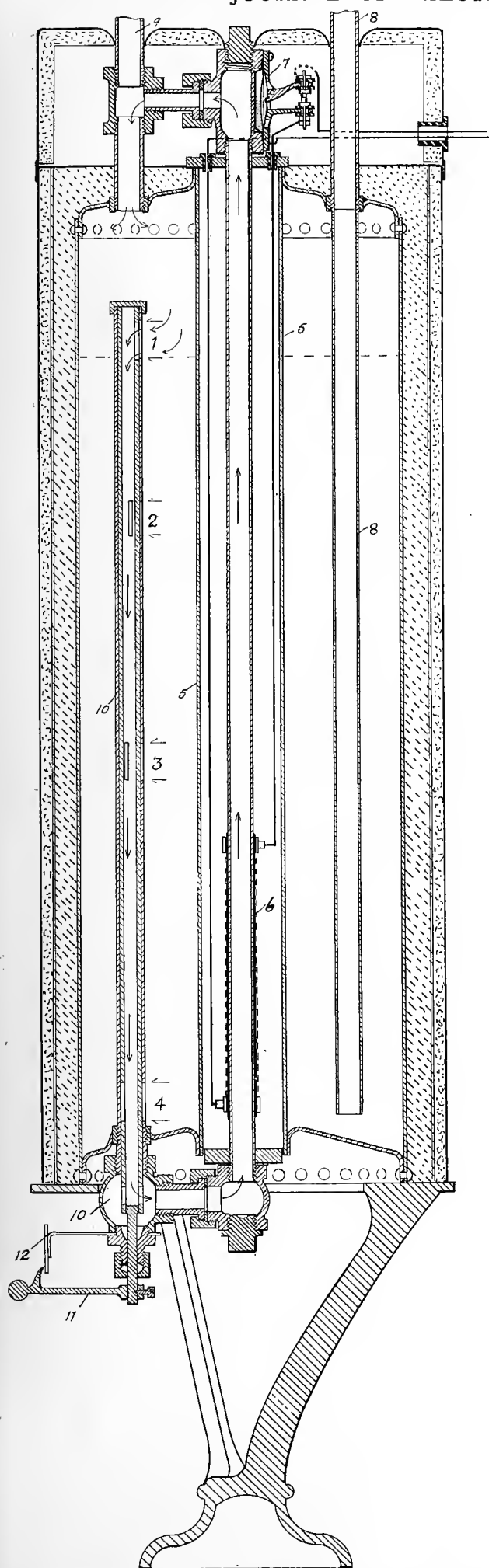


Fig. 2. An Electric Water Heater with Variable Service Valve for Automatic Temperature Control.

hours as is shown by the chart Fig. 4. The average temperature of water as it came from the tap was 184 deg. F.; the cold water temperature averaged 62 deg. The temperature of the water was thus increased an average of 122 deg. F. During ten days' service the current consumption was 24.5 kw.-hr. and the water used was 70.8 gal, or 589.76 lb.

The service efficiency was 86 per cent and the cost to the consumer was at the rate 1.03 cents per gal. at the rate paid which was three cents per kw.-hr.

Fig. 3 shows the load chart. This shows that water was used only during the usual office hours and it is apparent that if more water were used or the storage tank was smaller and current demand less, the apparatus would be still more efficient.

The writer is indebted to Mr. H. S. Lane of the Pacific Gas & Electric Company, who was in charge of the test, for data and the loan of load charts.

A point not to be overlooked in the case of doctors or dentists who use hot water is that boiling hot water can be constantly available. In the usual lavatory service a further economy results from very hot water. It is necessary to mix it with cold in the bowl and consequently results in saving heat which would otherwise be wasted by running away.

In the problem of domestic service much depends on the quantity of hot water available on different days in the week. Usually a larger quantity is necessary on Saturday or Monday than on the remaining days. It is also desirable that the water be very hot. The all week service efficiency is all important and by constructing the heating system as outlined in the description which follows, an all week service efficiencies of 90 per cent and over are possible.

A hot water boiler as shown in Fig. 2 surrounded by heat insulation is provided with an inner tube or casing (5) which is welded or riveted into each head. In this tube the usual circulating water heater (6) is installed. In circuit with this heater is connected a temperature control switch (7) which opens and closes the circuit depending on the temperature of the water passing through it. The usual inlet pipe (8) and outlet pipe (9) are arranged as in the ordinary kitchen boiler.

To provide for automatically maintaining hot water in only a portion of the tank the variable service valve (10) is provided. This valve is directly connected to the heating element circulating pipe and is arranged to admit water at certain levels in the tank to the heating element. Openings 1-2-3-4 are arranged to open successively as desired by moving the lever (11) to the corresponding number on the scale (12).

The water is heated to the desired temperature by passing through the heating unit once. After the hot water has reached the level of the opening in the valve it passes into port as at (1) and in passing through this element the temperature is raised sufficiently to cause the switch (7) to open the circuit. The advantage of this arrangement is that during the period of low water demand only a small portion of the boiler is maintained at a high temperature. The radiation losses are thereby reduced to the minimum. The method of stratifying the water into zones or levels of different temperature has been found to be entirely successful as diffusion of heat goes on very slowly in

still water. Provision is also made for the removal of scale. The thermal switch (7) will also protect the

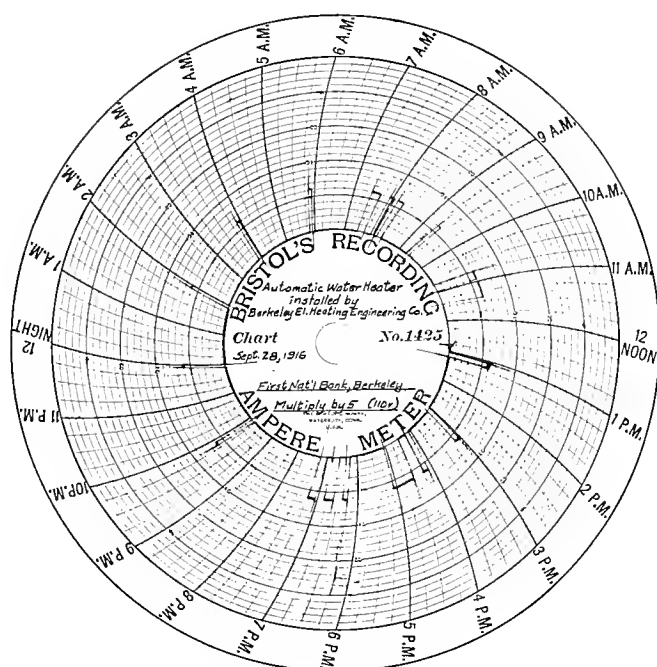


Fig. 3. Load Chart for Test of Electric Heater.

unit from excessive temperature, should scale form in the circulating pipe. Failures of heating units are rare.

In any case the heater or tank should be located as close as possible to the hot water tap, and all hot

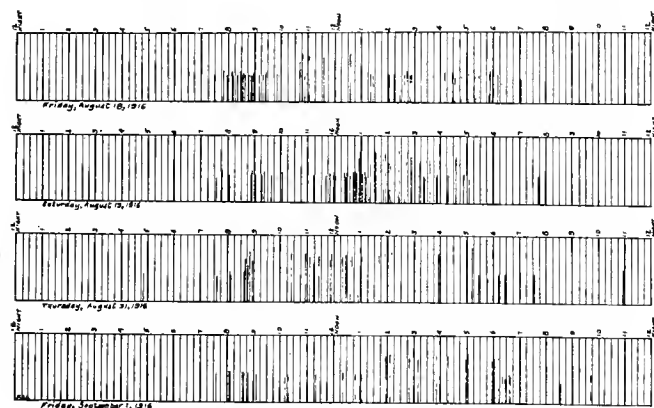


Fig. 4. Charts showing Periods when Water was Drawn During the Test of an Electric Water Heater.

water pipes insulated and so installed that no heat will travel along the pipe by reason of water circulation while the water is not being used.

Water diverted per acre by all the projects of the U. S. Reclamation Service averaged 5.38 acre-feet in 1914. Of this 2.87 acre feet per acre or 57.6 per cent of the amount diverted was delivered to farms. Of the 42.4 not delivered 7.1 per cent was wasted from the canals and 35.3 represented seepage and evaporation losses. A total area of 782,208 acres was irrigated in 24 projects, the total diversions exceeding four million acre feet.

CHARACTERISTICS OF IRRIGATION LOAD ON PACIFIC GAS & ELECTRIC CO.'S SYSTEM.

BY F. C. PIATT.

Investigations of the actual irrigation load conditions were made in 1914 in the San Jose and Solano districts for the purpose of studying possible improvements in distribution methods and reduction in investment. Many data on the quantities of water used, types of crops, acreage irrigated, water level and hours of use per year of the average irrigation plant were also collected.

These two districts are typical of two different types of agriculture. In the San Jose district orchards predominate; in the Solano district alfalfa is the principal crop. This affects the use of power in a number of ways, as shown in the following comparisons. There was a total of 13,275 h.p. of irrigation load in the San Jose district, and 3755 h.p. in the Solano district at the time these investigations were made.

The detail crop distribution is shown in Table 1. The monthly distribution of use is shown in Table 2. The difference in the monthly use in the two districts is mainly due to the difference in crops.

Table 1.—Area Irrigated.

Crop.	San Jose District.		Solano District.	
	Acre.	Per cent of total.	Acre.	Per cent of total.
Total	8,425	..	5,352	..
Alfalfa	1,543	18	3,739	70
Prunes	2,744	32	20	..
Apricots	1,060	13	331	6
Peaches	395	5	783	15
Miscellaneous fruits	1,659	20	110	2
Tomatoes	537	6	0	..
Truck crops	426	5	68	1
Miscellaneous	61	1	301	6

Table 2.—Actual Average Hours.

(Full Connected Load was Used.)

Month.	San Jose District.		Solano District.	
	1913.	1914.	1913.	1914.
January	10.0	1.0	.3	4.4
February	26.2	1.0	8.2	4.8
March	90.4	2.4	53.8	4.7
April	125.	9.0	99.1	9.2
May	160.	60.6	161.	28.1
June	144.	141.	182.	74.5
July	119.	89.0	180.	109.
August	87.7	63.0	206.	118.
September	50.3	55.2	138.	83.0
October	56.5	46.2	112.	38.4
November	23.2	25.4	2.5	10.6
December	4.0	..	13.9	..
Total	896.3	493.8	1,156.8	484.7
Consumer's load factor	10.2	5.7	13.2	5.7

Load Factors.—Table 2 also shows the annual consumer's load factor. In 1913 the rainfall was much less than normal, so that pumps were operated for longer than average periods. In 1914 the rainfall was somewhat above normal and the load factor correspondingly low. The load factor of the individual consumer for the days that his plant is in use is roughly 40 per cent, which represents 10 hours' pumping per day. In addition, circuit load factors were compiled for different conditions, as shown in Table 3.

Table 3.—Circuit Load Factors.

	San Jose.	Solano.
Weighted average of circuit load factors, day of peak	.49	.58
Weighted average of circuit load factors, annual	.151	.163
Total for district from individual consumer's load factor and diversity factor	.122	.156

The daily load curves for the peak day of the season are given in Fig. 1. The large day-time use with the reduction over the noon hour is noticeable.

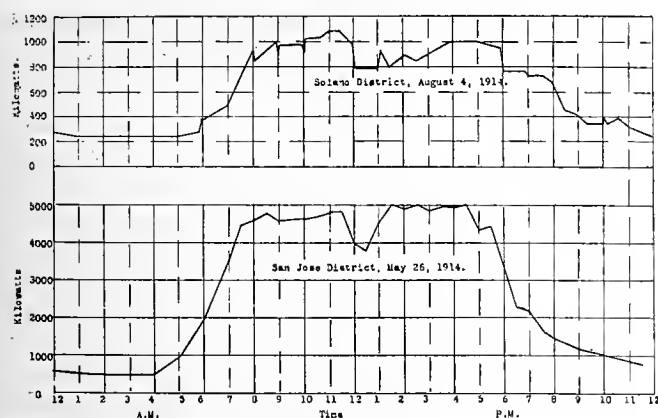


Fig. 1. Daily Irrigation Load Curves for Day of Peak Load for System.

The daily station peak load for the San Jose district for the months of largest use is plotted in Fig. 2. The marked reduction on Sundays is very noticeable. Use of power is maintained through October, as shown in Table 2.

The daily station peak load for a typical circuit in the Solano district in August, 1914, is shown in Fig. 3. The smaller Sunday use is also noticeable, but not to as great an extent as for the San Jose district.

Demand Factors.—Demand factor may be defined as; the ratio of kilowatts actual demand to kilowatts connected load. In the case of a motor, the kilowatts connected load would be the kilowatts input with the motor delivering its rated output. Instead of the true demand factor, the ratio of kilowatt demand to horsepower rating is often employed for the reason that it is more closely allied to the rate schedule, and simpler to apply practically. Assuming an average motor efficiency of 86 per cent, the true demand factor is obtained by multiplying the empirical ratio by 1.15.

For the San Jose district, the average actual demand factor was 0.79, and the kilowatts demand per horsepower of rating was 0.685. For the Solano district, the similar figures were 0.85 and 0.74, respectively.

Diversity Factor.—The diversity factor between consumers on the same circuit is defined as the ratio of the sum of the individual consumer's maximum demands (non-simultaneous) to the maximum circuit demand.

As actually measured, it involves obtaining by test as many consumers' maximum loads as possible, computing the remainder by means of an average demand factor and comparing the sum with the circuit peak, as shown by the station log or graphic meters. All computations are based on demands lasting 15 minutes or longer.

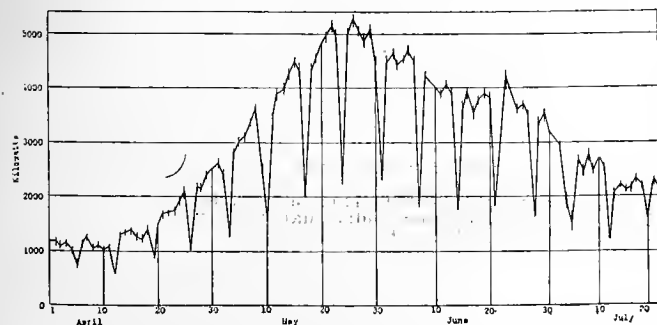


Fig. 2. Sum of Daily Irrigation Peaks for all Circuits, San Jose District.

The diversity factor thus obtained is lower than the theoretical diversity, due to the fact that the peak load on the circuit, as shown by the meters, includes losses in the primaries, transformers, etc., in addition to the instantaneous sum of the diversified loads. The diversity factors given are those representing conditions as they are, with station peaks including losses, as this is the only figure of practical importance.

In addition to the diversity between consumers on the same circuit, there is also diversity between irrigation circuits fed from the same substation, and between irrigation peaks of substations in the same district, etc.

The diversity factors obtained are relatively low, due to the fact that irrigation is carried on almost simultaneously by most of the farmers. The long lines are more likely to have high diversity than the short lines, as they naturally extend over a variety of land suitable for various types of crops. Lines supplying alfalfa will have a higher diversity than those supplying chiefly fruit, as shown by relative results in Solano and San Jose. This is because the irrigation of alfalfa is continuous for a period of 5 or 6 months, the exact time at which each farm is flooded depending largely on the conditions on the individual farm.

With fruit, the natural period of ripening forces all the farmers to irrigate at about the same time, generally a few weeks before the fruit is ripe. Other irrigation is also generally given after the fruit is off the trees, and again in winter.

The prospect of improvement in the diversity factor in the future does not seem very encouraging, as the farmers are more closely standardizing irrigation methods, thus making it more probable that all will irrigate at about the same time of year, with a resulting lower diversity factor. The diversity factors for different conditions are given in Table 4.

Table 4.—Diversity Factors.

	San Jose District.	Solano District.
Between consumers on a circuit.....	1.47	2.27
Between circuits	1.14	1.07
Between consumers and district peak	1.67	2.43

Additional Irrigation Data.—Table 5 shows some details with regard to average size of pumping plants and the acreage supplied per plant.

Table 5.—Additional Irrigation Data, 1914.

	San Jose District.	Solano District.
Acres per plant; average.....	47.	37.1
Connected h.p. per acre.....	.546	.375
Average h.p. per plant.....	25.0	15.0
Kw. demand per acre.....	.374	.273
Average discharge g.p.m.....	571.	351.
Average discharge g.p.m. per acre.....	12.2	15.3
Average depth to water; not pumping.....	45.5	24.4
Average depth to water; when pumping....	60.3	36.4

The figures for horsepower per acre, average pump discharge and discharge per acre are of interest as indicating practice followed in the territory covered, but are a proper guide to future installations only if the farmers are using water in the most efficient manner.

The water levels within the San Jose district show unexpected variations that are not explained by surface topography, being probably due to the configuration of the substrata. In the Solano district, the water levels between wet and dry years may vary 15 ft. The known fluctuation near San Jose is from 25 to 30 ft., the average for 187 plants being 27.4 ft.

By multiplying the average hours' use per year by the average rate of discharge per acre in 1914, the re-

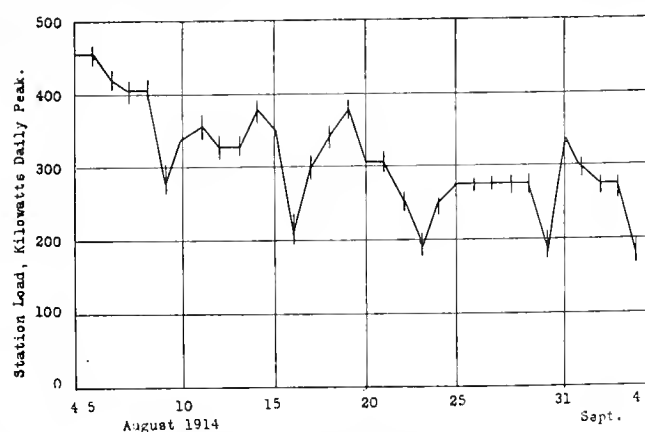


Fig. 3. Monthly Load Curve, Rice Line, Dixon Substation, Solano District.

sulting estimated water pumped in inches depth per acre becomes 13.4 for the San Jose district, and 16.8 for the Solano district. Similar figures for 1913, using the same pump discharge as for 1914, were 24.3 and 39.1 inches, respectively. Due to the lower water level in 1913, less water would be pumped so that these figures are somewhat excessive. In the San Jose district there is some winter irrigation from ditches fed from streams so the depth of water given above is not all the water actually put on the ground per year.

HYDROELECTRIC DEVELOPMENT IN NEW ZEALAND.

A statement has just been given out by the chief electrical engineer connected with the Public Works Department of New Zealand covering the Lake Coleridge Government Hydroelectric Plant located on the outlet of Lake Coleridge in the Canterbury District in the South Island, this being the first government electric plant on a large scale in this Dominion.

This plant has cost the government \$1,601,079, and the first year's operation shows that the plant paid operating expenses, although only a small proportion of the power was sold.

According to the report, the introduction of hydroelectric power into Christchurch has caused the retail price for domestic lighting to fall from 12 cents to 6 cents per unit, and the retail price for power from 6 cents to 3 cents per unit, and the price for power in bulk from 4½ cents to 1 cent per unit.

It is reported that there are a few electric vehicles in Christchurch using current from this plant, with the result that the power costs much less than one-half of the cost of benzene or gasoline.

This seems to demonstrate that the hydroelectric development in New Zealand can be successfully undertaken by the New Zealand government, and it is proposed to install similar plants in the North Island, and with that in view surveys are being extensively made of two special systems, each located within a radius of 100 miles of Auckland.

It is probable that these schemes will be well in hand for development shortly after the close of the war, and it would be well for American interests to get in touch so as to be posted in regard to these developments as they proceed.

OUTDOOR DIVERSIONS IN THE REGION OF HYDROELECTRIC CONSTRUCTION CAMPS.

Much has been written concerning the accomplishments of engineers in their construction work in the high Sierras and other mountain fastnesses of the West. Little has been said on the other hand, concerning the wonderful out-door life they and their families enjoy while such work is in progress.

Here is a picture of a thirteen-year-old lad, whose uncle has one of the sub-contracts connected with the Hetch Hetchy work. His hours of leisure in this wonderful section of country have been spent in perfecting himself as a naturalist along which lines he has already attained some eminence.

About a year ago one of the professors of vertebrate zoology from the University of California happened through and upon noting Donald McLean's rare



A Profitable Diversion in an Hydroelectric Region.

collection engaged his services for procuring certain specimens of which the university is in need. So as each month goes by Donald is finding that he is more able to put to a practical use his immense store-house of bird lore.

Donald's collection of some two hundred different specimens as shown in the illustration is most interesting to observe at close range. Almost every conceivable bird known to the layman at least may be found among them. They range all the way in size from the tiniest bird in America known as the Calliope Humming bird which spreads its wings scarcely three inches, to the great Blue Heron that measures over seven feet from tip to tip of wings.

SOME RECORD-BREAKING CROP YIELDS.

The Bureau of Crop Estimates of the Department of Agriculture recently quoted the following as the highest yields reported by their field men or correspondents:

Crop.	Unit.	Yield per acre.	Locality.	
			State.	County.
Wheat	Bu.	117	Washington.	Island.
Oats	Bu.	184	Washington.	Skagit.
Barley	Bu.	123	Idaho.	Twin Falls.
Flaxseed	Bu.	30	Montana.	Fergus.
White potatoes.	Bu.	790	California.	Eldorado.
Sweet potatoes.	Bu.	600	Tennessee.	Roane.
Cotton	Lb.	6,000	Georgia.	Toombs.
Rye	Bu.	54	Nebraska.	Lincoln.

These represented single fields or small tracts varying from 1 to 20 acres.

INDUSTRIAL CHANGES IN EUROPE.

In an address given during the week just past by Edward N. Hurley, chairman of the Federal Trade Commission, Mr. Hurley emphatically called attention to the fact that America must wake up to her pres-day day responsibilities. He said in part:

When we think of Europe we think of a continent engulfed in war, devastated and disordered, but I want to say to you, that we must correct that conception. While in many respects we know little of what is going on in the warring nations, we do know that within sound of the guns, almost within reach of the falling shells, Europe is reorganizing her industries. Under the stress of a life-and-death struggle every effort is being to obtain the highest efficiency in the production, the distribution and the use of commodities of all kinds. Conservatism in industrial ideals and methods has been blasted and shattered to pieces in the shock of war, old systems that normally would have hung on for years have been discarded in a day, old equipment that would have been retained for years has been scrapped as fast as possible for new installations of the most advanced types. New processes are being discovered, new inventions are being made, and new forms of organization are being created. Let me illustrate. Industrially, France has been pre-eminently the land of small scale, highly individualized production, but she now lacks human hands. In France little farms that for generations have been farmed practically by hand or with the aid of a horse or two, are being thrown together and farmed co-operatively by tractors, gang plows and modern agricultural implements. France must rely on machinery. Her business men are studying and are applying American systems of manufacture in factory construction, in equipment and in large-scale, highly systematized production.

England industrially has been pre-eminently the land of yesterday. Conservatism was the dominant characteristic of British business. While Massachusetts was making textiles with automatic looms under conditions that permitted one operator to tend from 16 to 24 machines, Lancashire clung to old equipment and conditions under which one operator could tend but four machines. But at last England is aroused, and today American books on efficiency and scientific management are being bought by the hundred and studied all over England. The war has compelled Great Britain to make thirty years of industrial progress in thirty months.

Before the war Germany was probably the most highly organized and efficient manufacturing nation in the world, but in Germany organization and efficiency have been still further developed, and, no matter whether victorious or defeated, the Germany that emerges from the war will be years ahead of the Germany we knew in 1914.

These changes are of great concern to us. We may not realize this today, because things are coming our way now, but we must look ahead to the future conditions we must prepare to meet. Almost before we know it we will find a new Europe competing against us with war-sharpened brains and war-hardened muscles, not only in our foreign markets but also right here at home. If our industries are not to be caught slow of mind and flabby of muscle we must improve our business organization, must increase our manufacturing and merchandising efficiency and must keep pace with every step in Europe's industrial progress.

A gopher bounty of 10 cents each is paid on the North Platte project in Nebraska by the water users. In 1915 bounty was paid on 33,580 gophers. An assessment of 3 cents per acre has been made to cover the bounty for 1916. About 70,000 acres were irrigated on this system in 1915.

HOW CROP STATISTICS IN IRRIGATION ARE GATHERED.

Crop or other agricultural statistics can be secured in various ways. Such statistics may be needed for irrigation or for agricultural power. The U. S. Reclamation Service secures yearly quite complete data from each landowner under its systems on the yield and value of all crops, areas cultivated, amount of stock, etc. These are desired for use in determining the progress of development on each project and the results being secured from the use of water. They are secured by means of an individual canvas.

Other systems may desire data on the average yield of crops or other factors connected with the farms. One method used is to select a certain number or proportion of all farms and use the average of these as the average of all. This has the advantage of cheapness and if fairly selected the results may be reasonably accurate. At least 75 to 100 farms should be used to give an average for large areas.

Inquiries through the mail will not generally give satisfactory results. Usually not over 30 or 40 per cent will reply and many of those received will be incomplete. Where water or power is paid for monthly it may be possible to get the users to furnish answers to such inquiries when making or mailing payments.

The area of each crop irrigated on each farm is often needed in planning the operation of irrigation systems, particularly under rotation methods of delivery. This can be secured by making the filing of such data with the annual application for water a prerequisite of service.

In collecting data from individual farms one man can usually cover about 20 farms per day. If the data collected is general and the farms small, a larger number may be secured per day. If many return trips are required to find those missed at the first call or if much detail is required, the average number of farms per day may be less than twenty.

Data on special crops may often be available from other sources. The sugar companies have quite complete data regarding areas under beet contracts. Various selling organizations may have much useful information regarding the crops which they handle. Such information may be used to lessen the amount and expense of statistics collected directly from the farmers.

In many cases information may be desired on matters of which the farmer keeps no definite record. Such a question would be the time pumping plants are operated at a flat rate schedule. It has been found by the U. S. Department of Agriculture that the average of a sufficient number of individual estimates on such questions will usually be quite closely correct unless there is some outside element to affect all estimates.

The engineer in his business life may draw a forceful lesson from the farmer. The farmer who regretfully says, "A poor crop this year! Oh, well, a better one next year!" may be a bit of a philosopher, but he is not much of a farmer unless he gets busy and tries to find out *why* the "poor crop this year" and what he must do to avoid such a result under similar or worse conditions in the future.

PLANS FOR AMERICA'S ELECTRICAL WEEK AT SAN FRANCISCO.

San Francisco is the first of the Pacific Coast cities to decide upon a complete plan of action for tying in locally with the Society for Electrical Development's national celebration of America's Electrical Week. In a report to the general committee, of which John A. Britton is chairman and S. V. Walton vice-chairman, the committee of arrangements, consisting of F. H. Leggett, R. M. Alvord, E. B. Strong, S. V. Walton and P. C. Butte has recommended a comprehensive participation as follows:

(1) The center upon which all other activities is to be focused are six electrical demonstration shows to be conducted in each of the several districts of the city. The largest will be a great exhibit illustrating the use of electricity on the farm and in the home which will be installed in the nave of the Ferry Building, in connection with lectures on electricity by the California Development Board. Another exhibit is to be installed in the board room of the Chamber of Commerce in the Merchants' Exchange Building. Still another will be put in a large vacant store in the heart of the retail shopping district. The Western Addition will be taken care of by a demonstration room located close to Fillmore and Sutter streets. The Richmond District, by a store at Sixth and Clement, and the Mission by a store at Twenty-second and Mission streets. In each case these stores are to be rented by the committee for two weeks' period and in them will be installed a complete working exhibit of various types of household appliances, including electric ranges, electric water heaters, heating devices, washing machines, irons, vacuum cleaners, lamps, etc. Each of these stores will be in charge of a salaried attendant and each device will be demonstrated by women demonstrators furnished by the various concerns exhibiting the apparatus.

Each store is to be equipped with electric signs and is to be handsomely furnished throughout. No devices are to be sold, though a pamphlet will be printed giving a list of the dealers from whom the materials may be purchased. The general committee will stand the entire expense of these six exhibits, allotting the space to interested companies in proportion to their amount of subscription toward the expenses of the week. These subscriptions will be solicited from the central stations, manufacturers' representatives and jobbers. The dealers will not be approached on this part of the program.

(2) As indicated in the above, the Chamber of Commerce and the California Development Board are co-operating actively in the campaign plans, being represented on the committee by Mr. Newton Lynch. The San Francisco Chamber of Commerce, which is the largest chamber of commerce in the United States, has over 8000 members. They issue a weekly bulletin on activities and will devote the first page of two issues exclusively to the plans. The California Development Board send out 35,000 bulletins each month, which will contain full notice of the week's activities. Both organizations will use poster stamps on all outgoing mails. The California Development Board will give daily lectures on electricity in their rooms in the Ferry Building and will of course emphasize the exhibit in the Ferry nave. As the Ferry nave is the largest passenger terminal in the world, with the possible exception of Paris, handling an average traffic of more than 125,000 persons daily, the exhibit in the nave should be particularly effective.

(3) The ballroom of the Palace Hotel has been reserved from November 29th until December 9th, for the purpose of holding electrical lunches which will be given each day throughout the week to such civic organizations as the Down Town Association, The Ad Club, Home Industry League, Commonwealth Club, Rotary Club, etc. A comprehensive exhibit of electrical devices will be arranged in this room for the inspection of those attending the lunches. Each Club

will be invited to hold its lunch in this room on its regular meeting day and the members will pay for their own lunches. The committee will provide a speaker on some electrical subject, will distribute literature and pull off various spectacular electrical stunts. In the afternoon, tea will be served to the ladies without charge and all the Women's Clubs about the bay will be invited to hold their meetings there and use the room as headquarters for members during the week. It is quite likely also that several evening lectures will be given in the ballroom.

(4) Every night throughout the week there is to be a street car pageant over the tracks of the United Railroads, who have donated flat cars and the use of their tracks for this purpose. An illuminated electric flag will head the pageant, then there will be a float showing "how grandmother kept house," featuring candles, spinning wheel and cooking over the fireplace, then a float "how mother kept house," showing kerosene lamps, wood stove, wash-board and tubs; broom and sad irons; and then a car "how to keep house electrically," playing up electric lamps, ranges, washing machines, vacuum cleaners and electrical appliances in general. The schedule of this pageant will be announced regularly in the papers.

(5) The use of billboards for poster advertising. After due consideration of a "half-showing" of the Society's 8-sheet poster in conjunction with the 16-sheet poster playing up the "Shop Early" and electric Christmas idea and calling attention to the demonstration rooms, the committee decided that half the number of handpainted boards displayed at carefully selected locations would be more effective. Consequently thirty-two such boards were authorized.

(6) Newspaper advertising. It is planned to publish co-operative electric pages in all daily papers during the week. Furthermore, an announcement for the week's activities will be printed in the amusement columns of each paper. Definite arrangements have been made for a complete publicity service covering Central California to supplement paid advertising.

(7) Lectures and demonstrations on electricity are to be given in the High Schools throughout the week.

(8) Complete plans for distributing the advertising matter furnished by the Society of Electrical Development throughout Central California have been worked out. This includes not only the use of poster stamps on outgoing mail of the Chamber of Commerce and California Development Board, but also the Pacific Telephone & Telegraph Company, Pacific Gas & Electric Company, Great Western Power Company, Northern California Power Company, Coast Counties Gas & Electric Company, and the Coast Valleys Gas & Electric Company. This will mean that practically every householder will receive at least one direct announcement of the week. Of course, extensive display of the Society's literature and electrical devices will be made by each central station and dealer throughout the territory.

The general committee consists of John A. Britton, vice-president and general manager, S. V. Walton, commercial manager, and L. H. Newbert, sales manager Pacific Gas & Electric Co.; M. L. Scobey and Jas. W. Redpath of the California Association of Electrical Contractors & Dealers; Carl E. Heise, district manager Westinghouse Electric & Mfg. Co.; F. H. Leggett, Pacific district manager Western Electric Co.; W. W. Briggs, general agent Great Western Power Co.; Dr. Thomas Addison, Pacific Coast manager and R. M. Alvord, supply manager General Electric Co.; T. E. Bibbins, president, and W. L. Goodwin, vice-president Pacific States Electric Co.; C. L. Chamblin, manager California Electric Construction Co.; Paul C. Butte, Butte Engr. & Elec. Co.; E. B. Strong, Journal of Electricity, Power and Gas; H. V. Carter; Robert N. Lynch, vice-president and manager Chamber of Commerce. A. H. Halloran has been engaged as campaign manager for the week.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

An electric boiler heater is being tried at Spokane, Wash., as a means for keeping the water warm in a fire engine between calls.

* * *

The salt content of the Pacific Ocean is 79. lb. per ton of water, of the Atlantic Ocean, 81 lb., and of the Great Salt Lake 175 lb.

* * *

Prosperity still continues among western mine owners and operators. In Butte, Montana, a monthly pay-roll of two and one-third million dollars, by far the biggest in its history, is now operative.

* * *

A unique register is maintained by the Pacific Gas & Electric Company at its Lookout Point near Emigrant Gap on the Lincoln Highway where a bird's eye view of the Lake Spaulding development may be obtained. Already a long list of distinguished names is enrolled.

* * *

Interesting compilations of governmental statistics show that the total annual cost of running the United States government is nearly a half billion dollars, while that of running the forty-eight states in the Union totals over a billion dollars annually.

* * *

"No house too old to be wired" is a catch-word of a New England central station company which is campaigning for the electrical equipment of all the homes in its territory. Recently the management had to make good by wiring old colonial homes built in the seventeenth century.

* * *

Contrary to prevalent ideas, castor oil has a wider application than that of its medicinal uses. In India, where the castor-oil plant grows, the oil is largely burned. It is believed to give a cooler and brighter light than other vegetable or mineral oil and it is said to burn more steadily.

* * *

Engine distillate, as obtained from California crude oil is a product too low in flash point to be used in kerosene and too high in boiling point to be used as gasoline or naphtha. It is frequently used to operate motor trucks and in the proportion of 40 per cent distillate and 60 per cent gasoline is also used in pleasure cars.

* * *

Members of the Naval Reserve Board have been placed on the rolls of the U. S. Navy Department as "officers of the United States Government." Immediately upon taking the oath of office the board members effected a permanent organization. Thomas A. Edison was elected chairman. William L. Saunders of the American Institute of Mining Engineers, and Dr. Peter C. Hewitt of the Inventors' Guild, both of New York City, were selected as vice-chairmen, and Thomas Robbins of the Inventors' Guild was appointed secretary.

More than three thousand feet above the center of the island state of Tasmania, the waters of the Great Lake are now harnessed in one of the greatest water power schemes yet planned in Australia. This government hydroelectric plant develops one hundred thousand horsepower, contracts for the sale of which have already been closed.

* * *

The new federal revenue bill, signed by the President on September 8, 1916, repeals the tax imposed on telephone and telegraph messages by the Revenue Act of October 22, 1914. It has therefore been unnecessary to collect the federal tax on such messages since midnight of September 8. All such taxes are to be collected, however, on messages sent prior to that date and not paid for.

* * *

More than four million dollars' worth of silk, the largest shipment from Japan this year, left Seattle recently in sixteen special cars over the Chicago, Milwaukee & St. Paul Railway for New York City. This railroad is the first to electrify its transcontinental system. It would seem that the next step would be to electrify Western industrial life so that this raw product might be manufactured in the western instead of eastern centers.

* * *

Apropos of the statement in recent press dispatches that Norway has just put into operation the first stone vessel ever built, resembling a barge, the ribs of steel and the hull of concrete, the Bureau of Navigation, Department of Commerce, says that it may be worth noting that the scows A. S. and G. Company, No. 33 and No. 66 were built of concrete at Fairfield, Md., in 1912 and 1913, respectively, by the Arundel Sand & Gravel Co., of Baltimore, Md. These vessels measure approximately 112 ft. in length and 28 ft. in beam, and it is believed they are the first vessels ever built of concrete. The No. 66 was abandoned as unfit for service in the early part of the current year and the No. 33 is still in commission.

* * *

The earliest record of standardization to be found is in the introduction of the Greek alphabet initiated by Xerxes and which was refused by China and Russia. However that may be the most notable step in the realization of engineering standards, in so far as Great Britain is concerned, was in 1841, when Sir Joseph Whitworth introduced his standard screw thread. When urging the necessity for standardization, he illustrated his argument by mentioning that candles and candle-sticks were in use in almost every house, and nothing could be more convenient than for the candles to fit accurately into the sockets of the candle-sticks, which they seldom did. The lesson taught by his illustration lies at the root of standardization and necessarily carries with it disadvantage to the few for the advantage to the many.

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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"Voluntary investment in privately owned utilities (in California) is awaiting the determination of public policy relative thereto." This significant sentence succinctly sums up the utility situation not only in California but throughout the West. It is used by J. P. Lippincott, a well-known consulting engineer of Los Angeles, in the course of a paper on "Rates for Municipally Owned Public Utilities" as published in the September, 1916, Proceedings of the American Society of Engineers.

This statement is of wider scope than is covered by the author in his argument that the rates of a publicly owned utility should be based on operation, plus depreciation, plus reasonable interest on value, as are the rates of a privately owned utility. It embraces several of the underlying reasons for the present stagnation in utility investment in the West.

Recently there have been but few voluntary investments in Western utilities. Electric power companies have bought only such new equipment as depreciation and maintenance of service required. Were it not for the needs of the more prosperous industries of mining, lumbering, agriculture and ship-building, the electrical jobber and manufacturer would have but little business aside from the sale of lamps and household devices. Most of the power companies have confined their new development to plants which were planned three years or more ago.

New investment is awaiting the determination of public policy thereto. With the encouragement of private capital a great flood of Eastern money will flow into Western developments. With discouragement, this capital will seek other fields.

The agitation for municipal ownership of public utilities in the West is mostly in talk and not in deeds. In California nearly 95 per cent of the value of the street railways, gas and electric systems, water plants and telephones and telegraphs is privately owned. Excluding the water plants, the ratio is a fraction of one per cent. The prime reason of course, is that public funds are more needed for such other utilities as schools, sewers and roads.

The privately owned utilities are closely regulated as to rates and service. The publicly owned are not. Neither can a municipality be restrained from invading the field of an operating utility. Equity would at least suggest the same basis for rate-making so as to protect legitimate private initiative. The municipal plant represents an investment of public funds, the use of which should return a profit to the city instead of occasioning a loss as is the case when the general tax fund is drawn upon to pay interest and retire bonds. Consideration should also be given to the fact that the public utilities bear the burden of taxation. Whatever lessens their income reduces the tax receipts from this source and consequently increases the taxes of the private property owner.

To hasten the coming of the awaited day when public policy will be definitely determined and to create a favorable attitude of public mind toward private investment might well be the task of existing utilities. Aggressive action should replace passive waiting. Electric railway, telephone and power company officials know the facts, know that future development is

dependent upon both private and public investment. The public does not realize this. To teach the public this becomes a duty and a privilege which ought no longer to be neglected.

Due to the increasing market value of crude petroleum Western central station managers are once again confronted with the problem of hydroelectric development as compared with steam power for electric generation of energy.

During recent years the gigantic growth in consumption of electric energy foretells an unprecedented increase in the use of electricity from large and economical power stations in all kinds of industry requiring mechanical power. It means that electric power is to find an ever increasing usefulness in reducing certain metals, such as aluminum, from its ores and the refining of metals such as copper, as well as the use of electricity in tempering, welding and forging operations, and also in the milling of iron and steel. On the Pacific Coast especially it means not only increased uses in agriculture but the steady growth of use in great electrochemical industries, including many kinds of products, among the largest in point of consumption being the fixation of nitrogen in the air, thereby producing valuable fertilizers and other by-products.

Of late years the steam turbine and its auxiliaries have been vastly improved in efficiency and adaptability. In addition to this increased efficiency due to more economical units and the increased capacity from concentration of a number of very large generators in one central station, improvement in load factor has also resulted. This comes from the increase in the diversity of service as pointed out in a recent editorial of the Electric Journal, making it possible to deliver a much greater total output with a given peak capacity.

Improvements in mechanical stokers, superheaters, economizers and other adjuncts to the boiler plant of large electric stations also add economy of electric current production in these large power plants.

Added to these improvements, the low market price of crude petroleum on the Pacific Coast has made the development of steam electric power a grave competitor of hydroelectric effort in the West even in localities where natural conditions made hydroelectric development favorable.

As if to aid still further the fight of steam power as opposed to hydroelectric power, legislation in recent years has been so adverse as to practically discourage further development along hydroelectric lines. Indeed in some instances it has been argued that water rights are a liability rather than an asset to a power company.

Be this as it may, the present increasing cost of crude petroleum, if it is to remain at such figures, will put an entirely new phase upon the situation.

With oil at seventy-five cents a barrel it was shown in a hearing before the California Railroad Commission that hydroelectric generation and steam generation were of equal cost in production in at least one great company of central California. This company, it might be mentioned in passing, controls some

of the most valuable hydroelectric power possibilities in the West.

With oil soaring to a dollar per barrel, however, an entirely new condition of affairs is sure to exist. Hydroelectric development once again becomes the unquestioned champion of the field. It is certainly to be hoped that the crying need in readjusting the state or federal regulations of water powers which in recent years have proved unproductive of the fruitful results hoped for, will at once be met and opportunity given for a resumption of hydroelectric development so much needed in the West.

In the Journal of Sept. 9, 1916, there appeared an editorial entitled "The Perfect Electric Water Heater." In this editorial it is shown that an ideal electric water heater, operating at one hundred per cent efficiency, can never raise more than 4.06 gallons of water one hundred degrees in temperature by the expenditure of one kw.-hr. of electrical energy.

Using this ideal factor as a basis of computation, the efficiency of any electric water heater is easily ascertained. All that is necessary for one to do is to operate the heater over a working period of several hours, note the electrical energy consumed, the temperature rise of the water and the gallons of water heated during the interval of electrical application.

In the determination of the efficiency of electric water heaters great care should be exercised in seeing that the heater is working under stable conditions of operation. Otherwise freak efficiencies, due to the absorption of heat by the heating elements and its later transmission to the water, may in some instances show a greater efficiency than one hundred per cent which is of course impossible of accomplishment.

The problem of the heating of water by electrical means is one of enormous proportion. It is hard to even guess at the possibilities that will ultimately be made effective under heat storage by water.

Electric cooking, the supplying of hot water for household purposes and the heating of buildings are mere beginnings in such uses. Under an efficient method of storage of heat energy the long looked for solution of filling up the valleys in the central station load is at once solved and the economic advantages to company and consumer can hardly be estimated.

A feature of the heater described on another page of this issue that is well worth noting is the attempt of the inventor to solve the question of varying temperatures to which water may be heated.

Advantage is there taken of the fact that water, being a poor conductor of heat, may successfully be heated to different temperatures in strata and each stratum drawn off when occasion demands such temperature as may be found in that corresponding section.

The continued effort of inventors to solve the problem of electric water heating is beginning to bear fruit and the day is not far distant when enormous economic readjustments in power consumption must result both to the benefit of central station and to consumer.

PERSONALS

R. J. Davis, agent for the Century Electric Company, is at Los Angeles.

Fred Skeel, manager of the Crouse-Hinds Co. at Chicago, is visiting the Pacific Coast.

T. E. Bibbins, president Pacific States Electric Company was at Los Angeles during the past week.

T. A. Hunter of the Southwest General Electric Company was at San Francisco during the past week.

F. E. Newberry of the F. E. Newberry Company of St. Louis was at San Francisco during the past week.

N. C. Van Fleet and **W. E. Hayes**, electrical contractors of Santa Rosa, Cal., were recent visitors at San Francisco.

F. Harvey Searight of the Allis-Chalmers Company is spending a few weeks in the High Sierras on his vacation.

J. G. Monahan, representing the Sangamo Electric Company at Los Angeles, has returned from an extended Eastern trip.

W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company, is making an Eastern trip.

George A. Campbell, manager of the Truckee River General Electric Company, has returned to Reno from San Francisco.

C. R. Hunt, branch manager of the Robbins & Myers Co., recently returned to San Francisco from a ten days' business trip throughout the south.

H. N. Lauritzen, Holophane specialist with the Pacific States Electric Company, will spend the next month at the company's Portland and Seattle houses.

F. L. Webster, California manager of the Allis-Chalmers Company, has returned from a few weeks' motoring trip throughout the southern part of the State.

Walter M. Fagan, representative of the Hughes Electric Company, was recently married at Los Angeles. He will return to Chicago with his bride this week.

A. E. Chandler of the California Water Commission has left for Honolulu, T. H., where he is to assist the Hawaiian Water Commission in drafting a water code for the Islands.

E. A. Wilcox, formerly electric heating specialist with the Great Western Power Company, left San Francisco last week to attend the Jovian Congress at Indianapolis and visit Eastern cities.

R. D. Holabird of the Holabird-Reynolds Company and **C. C. Hillis** of the Electric Appliance Company attended the meeting of the Electrical Supply Jobbers' Association at Cleveland this week.

W. D'A. Ryan, illuminating engineer with the General Electric Company, addressed the Great Western Power Company's N. E. L. A. section at San Francisco October 8, 1916, on "The Path of Gold."

A. H. Halloran, vice-president and managing editor of the Journal of Electricity and Pacific Coast representative of the Society for Electrical Development, addressed the Los Angeles Jovian League, October 11th, on America's Electric Week.

J. E. Megson, formerly with the Busch-Sulzer Diesel Engine Company of San Francisco, is now supervising engineer of the St. Louis Light & Development Company, which are owners of twelve Diesel engine plants in the Middle West.

J. E. Baker has resigned as statistician for the Southern Pacific Company at San Francisco to become adviser to the Chinese Ministry of Communications at Peking, which has charge of all the mail, telephone, telegraph and railway systems in China.

C. L. Cory, professor of electrical engineering at the University of California, who is this year spending his sabbatical leave of absence from the university in the Eastern States, returned recently for a short visit in Berkeley and has again left for the East.

C. R. Gill, formerly superintendent of distribution for the Pacific Gas and Electric Company at Sacramento, has been made superintendent of the company's Placer county district with headquarters at Auburn, Calif. In recognition of his services his fellow employees presented him with a gold watch and chain during a dinner given him by the electrical men of Sacramento.

Eugene V. Griffes, who was general manager of the Oceanside Electric and Gas Company at Oceanside since 1905, has, since the sale of the company, returned to Los Angeles and located at 1134 Fielding street, Hollywood. Mr. Griffes is one of the earliest Associates of the American Institute of Electrical Engineers in Los Angeles, having entered in 1896, there being only one other member at that time.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The proposed San Francisco-Oakland bridge was the subject of an address by Harland D. Miller at the October 4th meeting, which was attended by nearly a hundred members. Mr. Miller's plan is for a bridge extending from the end of the Alameda mole to Second and Townsend streets, San Francisco, with an elevated loop to Second and Mission streets. The bridge would be 5½ miles long, consisting of a large number of short spans 25 ft. above tidewater. This would be sufficient to pass 95 per cent of the shipping, the remainder being cared for by a lift bridge. The cost is estimated at \$22,000,000 and four years would be required to complete it. Pile foundations would be used for the piers. Mr. Miller emphasized the need for the bridge by dwelling on the danger of ferry service and by showing that the ferry terminal is the largest in the world, 125,000 people passing through it daily.

Los Angeles Jovian Electric League.

The fall session of the league was fittingly ushered in with a luncheon at Jahnke's Tavern, Wednesday, October 4th. The festivities were under the direction of A. B. Nauert of the United States Steel Products Company, chairman of the day, and Jovians to the number of 150 gathered round the festive board, which was tastefully decorated with huge clusters of beautiful dahlias of the prize winning variety, furnished for the occasion by Messrs. Sherart and Ebert. At President Holland's request, absolute quiet prevailed for thirty seconds, as all present sat with bowed heads in memory of J. Harry Pieper, whose loss has been so keenly felt by all who knew him. A resolution of sorrow read by R. J. McHugh was then adopted. A letter from Mrs. Pieper and resolution adopted by the Electrical Development and the Jovian League of San Francisco were also read. The secretary was instructed to draw up a resolution on the death of Wm. Graves of the Southern California Edison Co., a faithful member of the league, who recently passed away. The yearly election of officers will be held at the next meeting and a committee consisting of A. B. Nauert, N. G. Graham and H. N. Sessions was appointed to select the nominees. Charles C. Selecman, D. D., pastor of Trinity Methodist Episcopal Church, possibly the most popular orator of any that have addressed the league in the past spoke on "Personality" in a talk replete with epigrams and stories wonderfully refreshing and instructive. It is his opinion that, contrary to the old belief, the average person thinks too little of himself, adding "that the whole world moves on the invisible, intangible thing called 'personality'; the chief asset of nations, cities, commercial organizations and the whole human race."

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The Idaho Power Company has been authorized to refund to such of the municipalities, Glens Ferry, Gooding, Jerome, Buhl, Wendell and American Falls, Idaho, as shall within six months from and after September 1, 1916, make a written election to take their municipal street lighting service under Schedule No. 4, of Tariff No. 5, of the Idaho Power Company, whatever difference there may be between the amount of the charges falling due to the company under its Schedule Q-2, for service supplied on and after August 1, 1916, up to and until the date of the taking effect in such territory of said Schedule No. 4, or up to and until such later date or dates as said municipalities may respectively elect to take service under said Schedule No. 4 within said six months' limitation, and the amount of those charges as they would have been if the same service had been rendered during the same period under the provisions of said Schedule No. 4.

NEWS OF THE CALIFORNIA WATER COMMISSION.

William H. Earl, for the Long Valley Irrigation District, has applied for permission to appropriate 550 cu. ft. per second of the waters of Long Valley creek, tributary to Honey lake in Lassen county for the purpose of irrigating 34,345 acres in the district. The intake canal, as proposed, is 10 miles long. The diversion dam is set forth as 100 ft. high, 365 ft. on top and 100 ft. on bottom of concrete and masonry, whose estimated cost is \$1,000,000. The present application is really the perfection of a previous one filed to hold the priority on the water while the irrigation district was being formed and complete maps and data compiled.

M. D. Graham of Wakefield, Del Norte county, has filed an application requesting permission to appropriate 3 cu. ft. per second of the waters of Granite Gulch creek, tributary to Hurdy Gurdy creek, for placer mining purposes. The main ditch and flume, as proposed, will be two miles long and the diversion will cost about \$1,500.

D. E. Kelliher and Katherine Kelliher of Eugene, Stanislaus County, have applied for permission to appropriate 2 cu. ft. per second, each, a total of 4 sec. ft., from Littlejohn creek, tributary to San Joaquin river, for irrigation purposes. Proposed main canals for the diversion will be about two miles long. There will be two pumping plants lifting the water from the stream to the canals at a combined cost of \$6,250 for the whole works, to water 200 acres.

R. J. Aden of Vallejo has applied for permission to appropriate for agricultural purposes, $5\frac{1}{2}$ cu. ft. per second of the waters of Putah creek in Lake county, within the Guenoc Rancho, by means of movable pumps of 6 and 8 in. dimensions, respectively. There is proposed to install 2,600 ft. of 8-in. pipe-line and 4,000 ft. of 6-in. pipe line. The lift is about 20 ft. The estimated cost is \$4,000, to water 616 acres.

Hartland Law and Nelson L. Salter of Emerald Bay, Placer county, have applied to the State Water Commission for permission to appropriate for domestic and power purposes the waters of an unnamed stream, tributary to Lake Tahoe. By means of a plant consisting of an 18-in. wheel, 4,700 feet of 4-in. casing, with a fall of 350 feet, applicants propose to generate about 10 theoretical horsepower, at an estimated cost of \$2,100. The plant will be used for lighting the premises of applicants.

Louisa S. Paulsen of Lewiston, Trinity county, has applied for permission to appropriate for placer mining purposes 20 cu. ft. per second of the waters of Rush creek, tributary to Trinity river in that county. There is a proposed main ditch $3\frac{1}{2}$ miles long, with hydraulic giants, the estimated cost of the works being \$5,000.

Sara Brodek of Los Angeles has applied for permission to appropriate 28 miner's inches of Brodek canyon in San Bernardino county, for use on 240 acres at an estimated cost of \$7,500.

TRADE NOTES.

Westinghouse Electric and Manufacturing Company, Westinghouse Lamp Company and R. D. Nuttall Company announce the removal of their San Francisco offices to the seventh floor of the First National Bank building, 1 Montgomery street, San Francisco, Calif.

The Electric Specialty Company, 525 Market street, announces that it is representing The Mica Insulator Company, New Jersey; The Continental Fibre Company, Newark, Del.; The Reynolds Electric Company, Chicago, Ill.; The Barkelew Electric Manufacturing Company, Middletown, Ohio.

Western Electric Company anticipate that this year's sales will nearly touch the hundred million dollar mark, considering only actual shipment of goods to customers. Incoming orders booked will greatly exceed this figure. The company's previous biggest year's gross was \$77,000,000. The directors have authorized plant additions costing over \$1,000,000 to care for demands. Over 23,000 people are now on the pay-roll.

NEW CATALOGUES.

Wm. B. Scarfe & Sons Company of Pittsburgh has just issued an attractive booklet of seventy-two pages on the subject of scientific water purification for all purposes. The booklet is well illustrated and should prove valuable to all interested in the subject of water purification.

Federal Sign System (Electric) has issued a complete loose-leaf catalogue in board binder. After giving full details regarding embossed letter signs, roof signs, special display and panel signs, there are sheets devoted specifically to the needs of industries using signs,—central stations, theatres, garages, drug stores, etc. Reference is facilitated by thumb index so that ready selection may be made of data pertinent to any business.

BOOK REVIEWS.

Handbook of Machine Shop Electricity. By C. E. Clewell; 4 by $6\frac{1}{2}$ in.; replete with tables and illustrations; pliable binding; first edition. Published by McGraw-Hill Book Company of New York City, and for sale at the Technical Book Shop, San Francisco. Price, \$3.00.

This book was undertaken about two years ago at the suggestion of the editors of the American Machinist in order to supply a convenient electrical reference book adapted to the machine shop. The viewpoint of the practical shop man has been kept in mind throughout. For the handling of circuits—both direct and alternating—for arriving at costs, for electrochemical soldering and welding, for lamps and shop lighting, and for shop motors with their applications, reference to this excellent little book will be found well worth the effort. The author is assistant professor of electrical engineering at the University of Pennsylvania.

Applied Electricity for Practical Men. By Arthur J. Rowland. Size $4\frac{1}{2}$ by 8 in.; 375 pp.; 323 illustrations; cloth binding; first edition. Published by McGraw-Hill Book Company, Inc., of New York, and for sale at the Technical Book Shop, San Francisco. Price, \$2.00.

This volume has been in the process of making during twenty years' experience in teaching applied electricity to practical electrical workers; to men who expect to make direct application of the principles given them in the class room to their daily work with commercial circuits and machinery. It is written wholly from the standpoint of the one who puts up and operates electric circuits and apparatus. Pure theory is avoided. The author is professor of electrical engineering at the Drexel Institute, Philadelphia. A helpful set of questions and problems are given at the end of each chapter. The clearness and simplicity of the work should commend itself to a large class of students and practical electricians.



NEWS NOTES



ILLUMINATION.

BUTTE, MONT.—Oak and Cherry streets are to have lighting posts.

SACRAMENTO, CAL.—North Sacramento has voted for the establishment of a lighting district.

SAN JOSE, CAL.—Plans for the electroliers proposed for the four corners of Market and Santa Clara streets have been taken under advisement.

POCATELLO, IDAHO—The light committee has prepared an ordinance which will provide for lights requested by the residents of the east side of town.

MALTA, MONT.—This place has voted to grant a 20-year franchise to the Standard Electrical Engineering Company for an electrical and steam heating plant.

YERINGTON, NEV.—The Yerington Electric Company has applied for a franchise for a period of 50 years to maintain an electric system in all streets in this city.

HUNTINGTON BEACH, CAL.—Bonds in the sum of \$20,000 for the purpose of acquiring a municipal gas system have been sold to R. H. Moulton & Co. of Los Angeles.

LOS ANGELES, CAL.—The city electrician has been instructed by the city council to use some of the street lighting fund for the lighting of Cherokee avenue and Leland way.

ESCONDIDO, CAL.—W. E. Gird, owner of a large ranch at Bonsall, has placed an order with the Southern Electric Company of San Diego for a complete electric lighting plant.

ST. JOHNS, ARIZ.—It is probable that an electric light plant will soon be installed here. D. K. Udall of the Nebo Electric Light & Power Company and J. P. Rothlisberger & Son are behind the enterprise.

RIVERSIDE, CAL.—A committee has been appointed by the Board of Public Utilities to act on the question of awarding a contract for the construction of ornamental lighting posts on Highland place.

SACRAMENTO, CAL.—The Oak Park Business Men's Association is launching a campaign with the object of obtaining modern electroliers for the main business section of Thirty-fifth street and a portion of Sacramento avenue.

SPOKANE, WASH.—The adoption of new specifications for the city's street lighting system and the advertisement for bids for its installation have been asked by Manager E. Darrow of the Spokane Heat, Light & Power Company.

EUGENE, ORE.—The estimated cost of the extension of the city light and power wires to Santa Clara and the extension out of that village as proposed is about \$6,000, according to figures submitted by C. W. Geller, superintendent of public utilities.

PALO ALTO, CAL.—The Board of Public Works has approved the report of City Engineer Byxbee in regard to the advisability of purchasing the property of the Palo Alto Gas Company, and recommended to the city council that the city proceed to acquire the property.

PORT ANGELES, WASH.—The City Council has voted to readvertise for bids for the purchase of \$25,000 of public utility bonds, to retire outstanding warrants and make betterments in the lighting system. Extensions of the lighting service for streets and residence purposes was ordered on Eighth and Fifth streets at an estimated cost of \$2,000.

MERCED, CAL.—The proposed installation of an electrolier system for Merced's business district will give the city one of the best and most efficient systems of street lighting in the State, according to Consulting Engineer C. T. Phillips of San Francisco who has been engaged by the city to

prepare plans and specifications. The lights will be controlled from a small substation located near the city hall.

HOQUIAM, WASH.—Hoquiam voters on November 7 will pass on a bond issue of \$175,000 for the purchase of the electric power distribution plant in Hoquiam. The bond project is the outgrowth of a proposal submitted to the city several weeks ago to sell the city electric current at a city service board. At present only lighting current for the greater part of the city streets is furnished by the Grays Harbor Railway & Light Company.

CENTRALIA, WASH.—Numerous concerns are installing small light and power plants for their own use, as it appears that Pe Ell will be without lights again this winter. L. A. Webb, manager of the Central Light & Manufacturing Company, has refused to reply to communications from the town council relative to furnishing lights and the company's franchise prevents any other company entering the field.

DOUGLAS, ARIZ.—The city council has received plans for a lighting system in the paved district. The plans, prepared by the city engineer, call for eight lights to a block on all north and south blocks in the paved district, four on each side of the street. The light standard adopted by the council recently will be 12 ft. high surmounted by 16-in. glass globes, containing a 400 c.p. light. On east and west blocks there will be ten lights to a block, with the same type of lights to be used.

TRANSMISSION.

EUGENE, ORE.—Announcement has been made that the Oregon Power Company will make improvements and extensions to its lines to the extent of \$90,000 or \$100,000.

NORTH YAKIMA, WASH.—Commissioners have granted a 25-year franchise to the Pacific Power & Light Company for pole line extension over county roads in Yakima valley.

ASTORIA, ORE.—The Pacific Power & Light Company will spend the sum of about \$80,000 here in placing wires underground in pursuance of an ordinance passed by the City Council.

EUGENE, ORE.—Charles Geller, superintendent of the local lighting plant, announces that plans for extending the transmission line to Santa Clara to supply farmers on the way are being made.

HOQUIAM, WASH.—Ordinance has been introduced in the City Council calling for a special election November 7 on question of bonding in the sum of \$175,000 to acquire a power distributing plant.

NORTH PLAINS, ORE.—A petition has been circulated among citizens of North Plains to ascertain how many electric lights and how much power can be used in the town, provided a satisfactory service is established here.

HOQUIAM, WASH.—An ordinance providing for the calling of a special election on Nov. 7 has been adopted by the city commission. The measure provides the city shall be bonded for \$175,000 to acquire a power distributing system.

EUGENE, ORE.—Oregon Power Company plans new improvements and extensions to cost between \$90,000 and \$100,000 in the Coos Bay holdings of the company. The company is also planning the extension of a line into the valley of the Coquille river.

WEAVERVILLE, CAL.—Application has been made by the Western States Gas & Electric Company for a 50-year franchise for conducting electricity over roads and highways

in Trinity county. Sealed bids will be received up to January 4 by the Board of Supervisors for said franchise.

SEATTLE, WASH.—The construction of a new power plant above Marblemount on the Skagit River is indicated by the filing of three water power rights by G. M. N. Tait of Seattle, permitting him to divert 15,000 cu. ft. of water per second. Electricity will be furnished to railways, factories, etc.

PRESCOTT, ARIZ.—The Arizona Hydraulic Power Company is the title of a new company organized by Ed. Meek and his associates, who will furnish capital for the development of hydroelectric power here. The plans are to construct a diversion dam at a point 23 miles below Camp Verde and to carry the water by ditch to the site of a power plant. It will then be carried seven miles to another power producing plant. This canal will take advantage of the fall in the river and generate about 3500 h.p. and 4000 h.p. respectively.

TELEPHONE AND TELEGRAPH.

BEND, ORE.—The Pacific States Telephone Company plans extensions in Bend and vicinity at a cost of about \$12,000. J. A. Halliday, Portland, is district superintendent.

SAN FRANCISCO, CAL.—The total revenue of the Pacific Telephone & Telegraph Company for its San Francisco exchanges amounted to \$4,388,493 for the year beginning October 1, 1915, to September 30, 1916, according to a statement filed by the company with the board of supervisors. The Telephone Company pays the city 2 per cent of its total receipts for its franchises.

TRANSPORTATION.

REXBURG, IDAHO.—Definite steps are being taken for the establishment of an electric line from Preston to Ashton. Electric lines now run from Salt Lake to Preston, and the plan is to connect with these lines. Pocatello business men are taking the initiative in the project.

STOCKTON, CAL.—The directors of the Stockton Terminal & Eastern Railroad have signed a contract with Paul & Caldwell to pave a portion of Roosevelt street and two blocks on Union street. By entering into the contract, the railroad company has saved its franchise from forfeiture.

SAN FRANCISCO, CAL.—During August the Municipal Street Railways made a net profit of \$17,890 according to a report filed with the Board of Public Works. The total receipts for the month amounted to \$123,127 and the operating expenditures were \$81,716. Depreciation charges amounted to \$23,421.

IRRIGATION.

CHALFANT, CAL.—Annie J. Crosby has applied for 2 cu. ft. per sec. of the waters of Piute Creek for irrigation purposes. A main ditch half a mile long will carry the water to 160 acres.

ALTURAS, CAL.—Ray Baker, Fort Bidwell banker, and O. C. Gray reported to the Northern California Counties Association that the financing of the Cowhead Lake irrigation project and the watering of 70,000 acres in northeastern Modoc is assured.

LINDSAY, CAL.—Owing to a technical error the board of directors of the Lindsay-Strathmore Irrigation District have readvertised for bids for the \$1,400,000 6 per cent bond issue of the district. Bids will be received at the office of the district here until October 21.

NORTH YAKIMA, WASH.—The Mt. Adams Water Power Company has applied for permission to withdraw water from

Big Muddy and Hell Roaring creeks. The promoters are asking for five year rights to develop power to pump water to land near Glenwood in Klickitat county.

IMPERIAL, CAL.—Two directors of the Imperial Irrigation District have gone to Yuma to confer with officials of the Yuma Water Users' Association and Reclamation Service regarding the removal of a weir in the Colorado river, which the Yuma people declare is a menace to their project.

OXNARD, CAL.—Earl N. Loib, J. P. Burke, Charles Donlan, Jos. D. McGrath, John Lagomarsino and Jas. P. McLaughlin of Oxnard have applied for permission to appropriate 23 cubic feet per second of Owens River Valley water. The sources of appropriation are lakes in Fresno and Madera counties. It is proposed to store 16,800 acre feet of water.

LOS ANGELES, CAL.—Plans for an irrigation project that will represent an ultimate investment of \$3,000,000 or more have been announced by the Victor Valley Chamber of Commerce. Water will be supplied to 35,000 acres of lands. The initial expenditure for reservoirs, dams and a bridge across Deep Creek, will be about \$2,000,000. It is expected that work will begin within the next few months.

FRESNO, CAL.—The promoters of the Pine Flat reservoir, Fresno county, in conjunction with an application filed with Federal authorities for a dam site, have made application to the State Water Commission for a diversion of 1,500,000 miner's inches, or 37,500 cubic feet per second, of the waters of Kings River in Fresno county for irrigation purposes. The project calls for the construction of a dam 295 ft. high and 1100 ft. long at the top. It is expected to develop 20,000 h.p. for use in pumping water through the irrigating systems.

SALEM, ORE.—Residents on the Ochoco Irrigation project in Crook county will vote on the question of bonding the project for \$1,000,000 to secure funds to carry out contemplated improvements, it became assured recently when the office of State Engineer Lewis approved in its general features the report of R. W. Rea, project engineer. Notice of the report's approval was sent to the directors of the project today. The project as approved by Engineer Lewis embraces 20,000 acres of land in Crook county. It is proposed to issue bonds on the basis of \$50 an acre valuation for the project.

SACRAMENTO, CAL.—Wm. H. Earl, for the Long Valley Irrigation District, has made application to the state water commission for permission to appropriate 550 cubic feet per second, or 1,000,000 acre feet, of the waters of Long Valley Creek, tributary to Honey Lake, in Lassen county, for the purpose of irrigating 34,345 acres in the district. The intake canal, as proposed, is ten miles long. The diversion dam is set forth as 100 ft. high, 365 ft. on top and 100 ft. on bottom, of concrete and masonry, whose estimated cost is \$1,000,000. The present application is really the perfection of a previous one filed to hold the priority on the water while the irrigation district was being formed and complete maps and data compiled.

LOS ANGELES, CAL.—The Llano del Rio Company of Nevada, with headquarters at Llano, Los Angeles county, has applied to the state water commission for permission to appropriate for agricultural purposes 3000 cubic feet per second of the waters of Big Rock Creek in Los Angeles county. The pipe lines to convey the water to the lands will be one and three-quarters miles long. The project will be known as the Big Rock Creek irrigation project. Included in the works is a dam 110 ft. high, 900 ft. long on top and 200 on the bottom, with a width of 50 ft. on top, impounding 5600-acre feet, the reservoir flooding 142 acres. The estimated cost of the dam is \$90,000 and the pipe lines \$40,000. It is estimated that it will take five years to complete bringing 4710 acres under irrigation.

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	List.	Sell.
100 Amp., T. P. S. T.	7.10	6.25
200 Amp., T. P. S. T.	10.98	11.00
400 Amp., T. P. S. T.	24.30	24.50
600 Amp., T. P. S. T.	33.46	33.50
30 Amp., F. P. S. T.	3.20	3.70
60 Amp., F. P. S. T.	4.72	5.80
100 Amp., F. P. S. T.	9.48	9.50

Knife Switches—250 V. Unfused

30 Amp., S. P. S. T.	.80
60 Amp., S. P. S. T.	1.20
100 Amp., S. P. S. T.	2.25
30 Amp., D. P. S. T.	1.20
60 Amp., D. P. S. T.	1.78
100 Amp., D. P. S. T.	3.38
200 Amp., D. P. S. T.	5.20
400 Amp., D. P. S. T.	12.20
600 Amp., D. P. S. T.	17.30
30 Amp., T. P. S. T.	1.80
60 Amp., T. P. S. T.	2.68
100 Amp., T. P. S. T.	5.08
200 Amp., T. P. S. T.	7.80
400 Amp., T. P. S. T.	18.30
600 Amp., T. P. S. T.	25.96
30 Amp., F. P. S. T.	2.40
60 Amp., F. P. S. T.	3.56
100 Amp., F. P. S. T.	6.76
200 Amp., F. P. S. T.	10.40
400 Amp., F. P. S. T.	25.94

Knife Switches—600 Volt.
Unfused, Not Quick Break.

30 Amp., D. P. S. T.	1.34
60 Amp., D. P. S. T.	1.65
100 Amp., D. P. S. T.	3.30
30 Amp., T. P. S. T.	2.10
60 Amp., T. P. S. T.	2.50
100 Amp., T. P. S. T.	4.90

Fused.

30 Amp., D. P. S. T.	1.96
60 Amp., D. P. S. T.	2.36
100 Amp., D. P. S. T.	4.60
30 Amp., T. P. S. T.	3.14
60 Amp., T. P. S. T.	3.78
100 Amp., T. P. S. T.	7.36

Combination—250 Volts.

D. P. Entrance, 25 Amp., Bottom Moulding.	.05
D. P. Entrance, 25 Amp., Top Connections.	.90
2 to 2 Wire S. B. Mains, Vertical, 15 A.	1.00
2 to 2 Wire S. B. Mains, Horizontal, 15 A.	1.00
2 to 2 Wire D. B. Mains, Vertical, 15 A.	2.00
2 to 2 Wire D. B. Mains, Horizontal, 15 A.	2.00
3 to 2 Wire D. B. Mains, Vertical, 15 A.	2.10
3 to 2 Wire D. B. Mains, Horizontal, 15 A.	2.10

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX

Number
25

	List.	Sell.
Automatic Door.		
Light "ON" with door open.	2.25	2.25
Light "OFF" with door open.	2.25	2.25
Conduit Box, with Clamp for Door Switch.	.40	.40
Time.		
Reliance	24.00	24.00
General Electric	30.00	30.00
Hart	36.00	36.00
Campbell	30.00	30.00
Anderson	42.00	42.00
Hartford		

Struck Up Plates for Push Switch.

1 Gang, 040 Metal.	.25	.25
2 Gang, 040 Metal.	.45	.45
3 Gang, 040 Metal.	.65	.65
4 Gang, 040 Metal.	1.40	1.40
5 Gang, 040 Metal.	1.75	1.75
6 Gang, 040 Metal.	2.10	2.10
7 Gang, 040 Metal.	2.45	2.45
8 Gang, 040 Metal.	2.80	2.80

Standard Plates for Rotary Flush Switches.

1 Gang	.53	.55
2 Gang	1.20	1.20
3 Gang	1.80	1.80
4 Gang	2.40	2.40
5 Gang	3.50	3.50
6 Gang	4.20	4.20
7 Gang	4.90	4.90
8 Gang	5.60	5.60
1 Gang, 040 Metal	.40	.40

Round Corners and Edges.

1 Gang	.27	.27
2 Gang	.54	.54
3 Gang	.81	.81

Tandem in One Vertical Row.

2 Gang	1.20	1.20
3 Gang	1.80	1.80
4 Gang	2.40	2.40

Knife Switches—250v.—Fused—Type A.

30 Amp., S. P. S. T.	1.08	1.10
60 Amp., S. P. S. T.	1.58	1.60
100 Amp., S. P. S. T.	3.16	2.80
30 Amp., D. P. S. T.	1.60	1.70
60 Amp., D. P. S. T.	2.36	2.50
100 Amp., D. P. S. T.	4.41	4.20
200 Amp., D. P. S. T.	7.32	7.30
400 Amp., D. P. S. T.	16.20	16.50
600 Amp., D. P. S. T.	22.30	22.50
30 Amp., T. P. S. T.	2.40	2.50
60 Amp., T. P. S. T.	3.54	3.50

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PER COPY, 25 CENTS

THE BEAR RIVER CANAL.

BY ROBERT SIBLEY.

ELECTRICAL REFRIGERATION IN A CAFETERIA.

BY H. N. SESSIONS.

UP-TO-THE-MINUTE SELLING METHODS.

BY S. C. BRATTON AND G. D. MANTLE.

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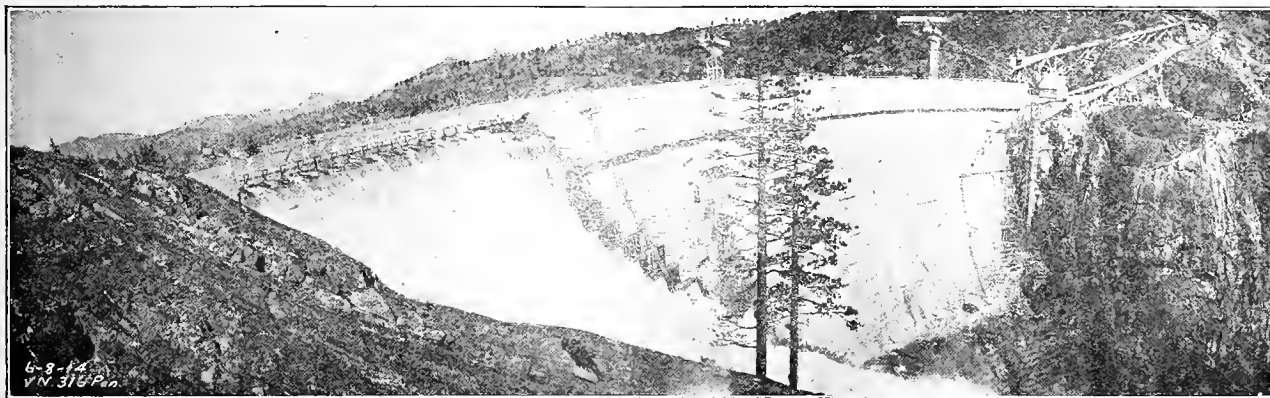


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Spaulding Dam showing Granite Ledge to the Right, which has been Tunneled for the Passage of Bear River Canal Waters.

THE BEAR RIVER CANAL

BY ROBERT SIBLEY.

Emigrant Gap is a breathing point for main line trains in their journey through the snow sheds of the Southern Pacific Company, as these trains trail their way over the high Sierras of Central California. From this breathing point the traveler may easily follow with his eye the great mass of waters impounded by Lake Spaulding and the snow-capped area from which this artificial lake draws its storage supply.

As set forth in the issue of the Journal for September 30, 1916, this deep impounded body of water is to rise 305 ft. above the flooring of the granite gorge upon which it maintains its footing. The ultimate storage capacity will be 97,000 acre feet.

A tunnel has been driven through the almost perpendicular granite wall shown to the right in the picture of the Spaulding dam in order to start the waters reservoirized in this lake on their journey toward hydroelectric power development.

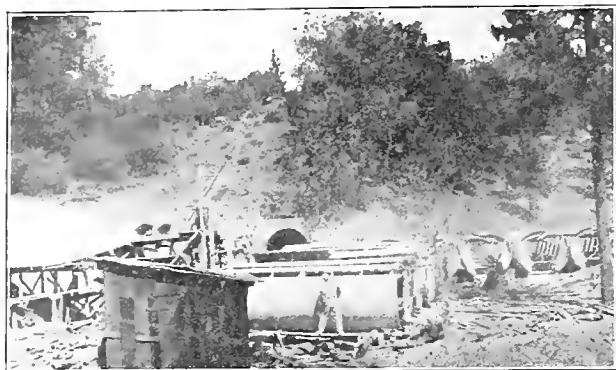
These waters, originating in the drainage area of the South Fork of the Yuba River, are conveyed through the Drum Canal over the pass which separates this drainage area from that of the Bear River and are finally dropped through the Drum power plant into the Bear River. Some miles below this point, near Colfax, California, they are again diverted in order to drive the wheels of the Halsey and Wise power plants, described in September 30th issue of the Journal. This artificially created channel is known as the Bear River Canal.

This canal has a carrying capacity of 350 ft. per second, is twenty-four and one-half miles in length, and is laid on an average grade of one foot per thousand. It consists for the most part of earth work. Just above Auburn, however, the canal is turned through a series of three 8 ft. tunnels before discharging into the forebay of the Halsey power house. This forebay has a capacity of about 200 acre feet, and a surface area of $12\frac{1}{2}$ acres. Earth embankments constructed from the excavated material have been made use of to create this reservoir.

The water, under a head of 342 ft., is then dropped through the Halsey power house into a small branch of Dry Creek. The penstock pipe is composed of 1773 ft. of wood stave and 1182 ft. of steel piping.

Immediately below the Halsey power house, a regulating dam passes the water through tunnels and ditches into the Rock Creek reservoir. From this point the water is conveyed to the forebay for the Wise power house, which has a capacity of about 38 acre feet and a surface area of four acres. From the forebay a penstock pipe 9800 ft. long drops the water through the Wise power house under a static head of 519 ft.

Of this penstock 1106 ft. is wood stave pipe, 96 in. in diameter; 463 ft. is tunnel driven through solid rock, and the remainder steel rivetted pipe, 84 in. in diameter at the tunnel end, finally decreasing to 66 in. at the turbine connection. Due to the extreme length



Collapsible Circular Forms for Concreting Tunnels.



Frame Work for Installation of Novel Multiple Arch Dam at Rock Creek.

and diameters installed, the friction head is quite high so that for the design of the turbine unit 510 ft. was assumed instead of the 519 ft. head actually installed. This effective head drops to 475 ft. under maximum load conditions.

The hydraulic features of the entire Spaulding development cover a strip of territory more than 30 miles long and at its upper end more than 20 miles wide, portions of the water coming from an elevation of more than 12,000 ft., and the final utilization is at an elevation less than 500 ft. above sea level. Its ultimate development will be the production of nearly 175,000 electrical horsepower and the supplying of artificially stored waters for an irrigation system covering more than 20,000 acres.

There are many features in the construction of the Bear River Canal that are interesting and instructive to know.

At the Rock Creek reservoir, mentioned above, a multiple arch dam 35 ft. in height is being erected. This dam is ultimately to have a height of 55 ft. Its unusual feature of design, which is the creation of the civil engineering talent of the Pacific Gas & Electric Company, is the freedom of motion that is given to each arch in order that it may properly adjust itself to varying strains and stresses that it may be required to carry. Each slanting arch being thus free in itself rests upon its own individual support. The connection is sealed by the pressure of water upon the arch, thus making it water tight.

The method of concreting certain portions of tunnels encountered in constructing the canal is unusual and novel. A series of cylindrical forms were constructed so that the form could be rendered of

smaller diameter than the tunnel bore desired. This collapsible, adjustable arrangement is shown in the illustration. Upon setting the form in place, a concrete mixer installed in the open passed its mixture into a pipe under pressure, which forced the pipe contents to be deposited in the side walls of the tunnel at any place desired by the operator.

In the design of the ditch proportions, the water section is built for the most part in the excavated portion and the excavated material made to serve as an additional safety embankment against possible disaster.

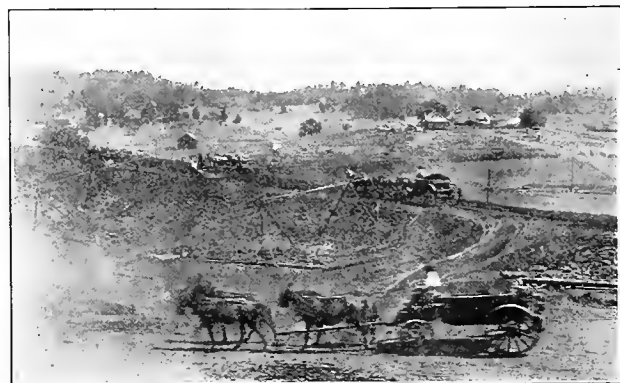
Practically every type of conduit is used in one place or another in the construction of the canal. For instance, at one point open ditch is observed to be followed by semi-circular steel fluming which again serves as a masonry lined run of canal. At another point the water passes from a forebay into wood stave piping, then through two pressure tunnels—concrete lined—again emerging into wood stave piping which finally serves the heavy steel riveted penstock piping that delivers the water to the power house wheels.

In the building of the forebay tram-work is largely relied upon for the hauling of the excavated material and its depositing upon the dam embankments. For excavating the material and loading it upon the wagons the steam shovel has been found useful and efficient.

The material that is excavated to form the earth dam embankments is first thoroughly wet down and later rolled solid with heavy cylindrically shaped rollers, followed by sheep's foot rollers, thus making the loose particles form one solid compact mass.



Typical Heavy Cut Section of Bear River Canal.



The Operation of Sheep-Foot Packers and a View of Sprays for Earth Settling.

The Pipe and Penstock Tunnel for the Wise Plant.

Leading from the forebay is 1106 ft. of 96 in. continuous woodstave pipe line, made from selected Oregon fir. For controlling the entrance of the water, an 84 in. motor operated butterfly valve is provided, this being one of a number of similar valves used throughout the development. The wood stave pipe line follows the ground contour, with an occasional cut to keep below the hydraulic gradient. It terminates in a tunnel, lined with reinforced concrete, which pierces a low ridge. The over burden is shallow, the sole object being to keep sufficiently below the hydraulic gradient to insure a full pipe under most severe operating conditions. The tunnel is 463 ft. in length and at its lower end is joined to a steel pipe line of varying lengths, as previously mentioned.

The last section of piping enters the power house and connects to the butterfly valve controlling the turbine. In laying this line, after a careful balancing of experiences with various types of construction found among the pipe lines of the company, it was decided to use the cheapest construction possible. A trench was dug roughly following the surface contour, of a depth to receive the lower half of the pipe. After riveting, the spoil was back filled. In discussion with the engineers, it was developed that no pipe line failure has ever occurred on the entire system, that could, even remotely, be traced to corrosion; also that insofar as service is concerned, pipe entirely covered or for its entire length in partial contact with the soil, gave better results than when supported on concrete piers. With pipes of such large diameter, the deformation from a true circle becomes important, reaching in some of the thinner sections as much as four inches. Under pressure the deformation is less, and the wall movement, when the pipe is emptied, is of sufficient magnitude to fracture the shoulders of the piers. For this reason pier construction was discountenanced. All lines are thoroughly covered with a coating of asphaltum paint at the time of laying, and at irregular intervals this coating is renewed where the line is exposed to the weather.

Because of the contour, a number of anchorages are necessary between the tunnel and the power house. These are of concrete, and of shape and size as dictated by the location. Where the walls of the pipe are $\frac{1}{2}$ in. or more in thickness no slip joints are installed, but in the upper portion, four slip joints are provided. The policy of the company engineers leans toward slip joints and other pipe specials of structural materials only, as it is feared that sound steel castings cannot be had in the thin, varied dimensional parts required in a suitable slip-joint.

Further Details of the Halsey and Wise Power Plants.

For the sake of clearness, certain features mentioned in the Journal of September 30, 1916, concerning the Halsey and Wise Power Plants, will now be described in further detail.

The prime movers are there referred to as Allis Chalmers Water Wheel units. This on first thought gives the idea that they are impulse wheels. Such is not the case. They are Francis type turbines. The prime movers on the exciters are Pelton impulse



Steam Shovel Method of Earth Removal.

wheels. The beautiful method of assembling by heating and chilling the shaft as described was given careful consideration in the design of the machine and and no trouble whatever was experienced in handling the work.

The transformers are not in compartments separated from the main generating room. They set in pits as described in the text but there are no barriers between the transformer room and the main generating room or even between transformers. In other words, they set right out in the main generating room, but have a floor level lower than the main generating room floor. There is a passage-way between two of these transformers from the main generating room to the high tension switch compartments, and there are concrete barriers on each side of this passage-way. This construction, however, was not adopted with the idea of isolating the transformers, but more as a safety measure for the protection of persons passing between them and near high tension wires. The high tension oil switches are in separate cells or compartments, the different legs of the circuit being separated by concrete barriers.

The stepup transformers are connected delta on the low side and star on the high side to give 110,000 volts. Taps are brought out of the high tension winding for 60,000 volts between wires or 34,000 volts between each wire and grounded neutral. The line connecting from Halsey and Wise to Stockton is of steel tower design with suspension insulators and constructed for 110,000 volts. For the time being, it will be operated at 60,000 volts but this will eventually be increased to 110,000. Not only will the temporary volt service out of these two stations tie in with the Electra line at Stockton but it will also tie in with the existing 60 k.v. line running between Deer Creek and Alta power houses and Sacramento.

The main prime mover in Wise power house is a Francis type turbine of the Pelton-Doble design.

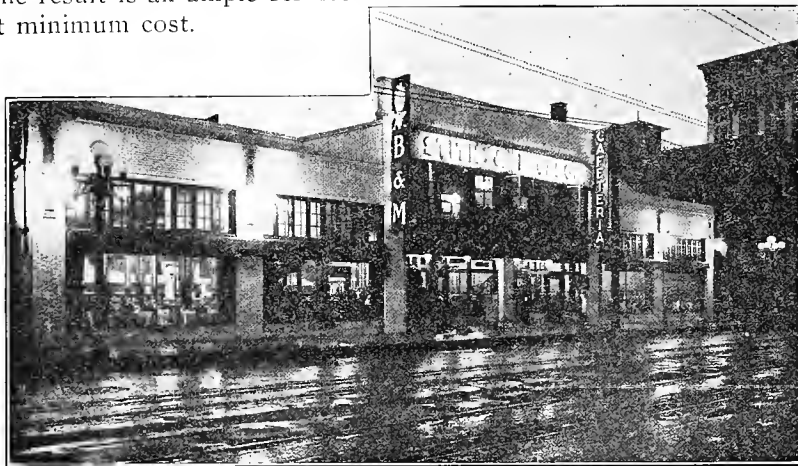
The relief valves for taking care of surges are actuated by the governor but through oil dashpots the time of operation of each can be adjusted so that on small or slow changes the relief valves are not opened. On sudden changes, however, the dashpot does not have time to act and therefore the relief valves are opened but close automatically within a pre-determined time limit.

ELECTRICAL REFRIGERATION IN A CAFETERIA.

BY H. N. SESSIONS.

(Description is here given of the method whereby constant low temperature is obtained for food preservation by means of electric refrigeration. The author is commercial engineer with the Southern California Edison Company, from whose house-organ this account is taken.—The Editor.)

The cafeteria, a Los Angeles creation, Spanish in name as most things typical of California, means to-day, as some people say, the last word in restaurant efficiency. Thrift, genius and enterprise have applied more science and system to the cafe, making the cafeteria an unbounded success. The cafeteria knows today its exact requirements for tomorrow—there are no uncertain peaks or surprising conditions to arise in its daily operation—all making for the adoption of scientific methods and machinery effecting economy. The result is an ample service at minimum cost.



The B. and M. Cafeteria at Night.

The B. & M. Cafeteria at Los Angeles is claimed to be the largest in the world and undoubtedly one of the finest—a one-story building covering 18,000 square feet, with basement and mezzanine. The normal seating capacity is 812, exclusive of the ice cream stand and soda fountain, and the daily average number of meals served since January 1, 1916, is 4950. Steady employment is being given to 160 men and women. No expense has been spared in architecture, furnishings and the latest appliances of every nature to make this institution beautiful, sanitary, comfortable, wholesome and economic. Much could be written in description of the many up-to-date innovations of this Los Angeles institution, but I will specialize with some details showing how thoroughly and efficiently its refrigeration is accomplished.

To save floor travel and time, various cooling cabinets or boxes, located at the most convenient places for serving the public, are stocked with different foods. A variation of a few degrees in temperature will cause

certain foods to discolor and spoil. For perfect refrigeration and preservation of quality and flavor, each class of food is kept separately in a dry, clean atmosphere, at an unvarying degree of temperature necessitated by its own variety; for example—fish at 33 deg. F., berries at 38 deg. F., meat at 40 deg. F. and so on.

All of the foregoing requirements are met with the system of refrigeration employed by the B. and M. Cafeteria. Twenty-three separate refrigerated boxes and cabinets are used in this cafeteria, as follows:

Two ice cream cabinets, one on each side of double soda fountain. Each holds three five-gallon cans in calcium chloride solution maintained at 20 deg. F. by direct expansion;

One cabinet 3 ft. 6 in. by 2 ft. 3 ft. at soda fountain for salads, bottled water, etc., at 40 deg. F.;

Two cabinets 4 ft. by 2 ft. by 2 ft. 6 in., one at each of two butter counters, at 42 deg. F.;

Four cabinets 8 ft. by 2 ft. 6 in. by 2 ft., one at each of four serving counters for salads, creams, pastry, fruits, etc., at 42 deg. F.;

Four ice cream cabinets, one at each of four service counters, each with capacity for four five-gallon cans in calcium chloride solution held at 20 deg. F. by direct expansion;

One fish box in kitchen 5 ft. by 2 ft. 6 in. by 2 ft. 6 in. at 33 deg. F.;

Two cut meat boxes in kitchen 5 ft. by 2 ft. 6 in. by 6 ft. at 36 deg. F.;

Two fruit and pastry boxes in kitchen 5 ft. by 2 ft. 6 in. by 6 ft. at 38 deg. F.;

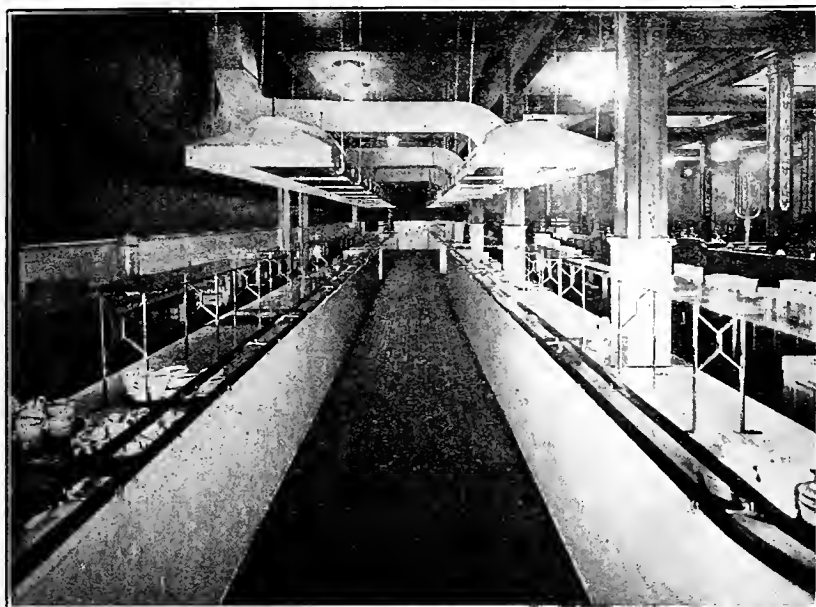
Three-room cold storage apartment in basement 16 ft. by 30 ft. by 7 ft. 6 in.; one room for eggs, smoked meats, etc., at 60 deg. F.; another for uncut meat at 40 deg. F.; and the third room for poultry, etc., at 40 deg. F.;



Perfect Illumination of the Interior.

One reserve ice cream cabinet in basement with capacity for forty five-gallon cans in calcium chloride solution, maintained at 20 deg. F. by direct expansion;

One filtered water cooler in basement 4 ft. by 4 ft. by 4 ft., with capacity for 500 gals. per day at 40 deg. F. Water circulated through this is piped to two six spout stands one at each side of dining room.



Extensive Serving Counters showing Electrically Operated Suction Ventilators.

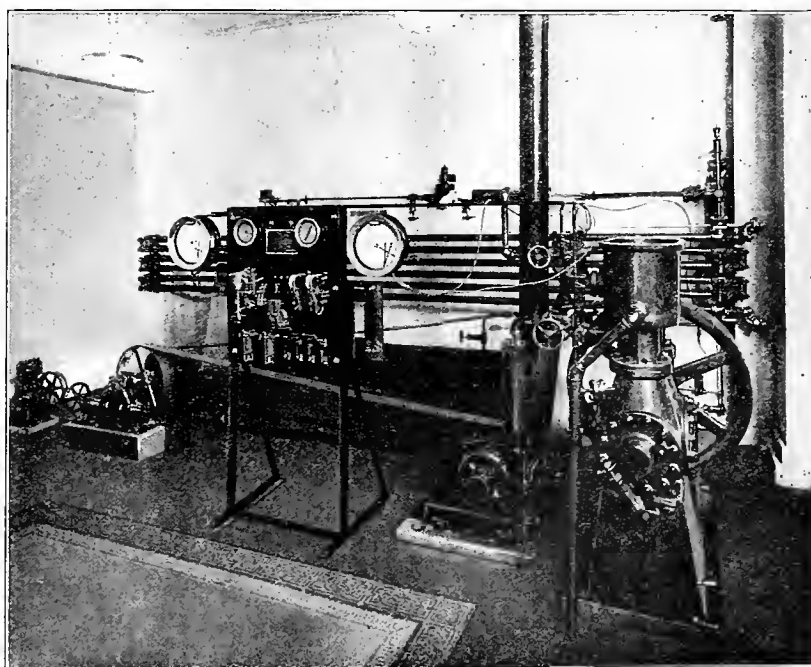
To accomplish this refrigeration with ice would be a feat utterly impossible. With ice the low temperatures attained are not practical; constant unvarying temperature cannot be automatically maintained; the atmosphere of the boxes would be humid, clammy and unsanitary; the additional space required for ice and a drainage system for its meltings would be an unnecessary incumbrance; the placing of tons of ice daily in these twenty-three boxes would be an out-of-date procedure, to say nothing of a prohibitive expense compared with the ideal method here employed.

This independent, electrically driven refrigeration plant was designed, manufactured and installed by The Automatic Refrigeration Company of Hartford, Connecticut, to suit the individual wants and conditions of the B. and M. Cafeteria. The outfit consists of a $7\frac{1}{2}$ h.p. Type K.T. General Electric motor belted to an Automatic Refrigeration Company's compressor of 9000 pounds daily refrigeration capacity. No brine circulation is employed, the system being handled by the direct expansion of liquid ammonia through refrigerating lines always partially flooded with the refrigerant under a low pressure and temperature. The work of refrigeration is nearly equally divided between two low pressure distributing lines, on which lines the chambers being cooled are connected in series with each other. Each chamber or box refrigerated is cut into the low pressure line by a by-pass valve, and by the adjustment of the by-pass valve the temperature of each cabinet or chamber is set and maintained constantly at any desired degree. The two low pressure lines or circuits are about 1500 ft. each in length and of pipe ranging from $\frac{3}{4}$ in. to $1\frac{1}{4}$ in., the exposed portions of the line being carefully insulated with specially thick cork cover-

ing. These circuits operate at approximately thirty-five pounds pressure, which pressure is maintained by automatic expansion valves from a $\frac{1}{2}$ in. high pressure liquid supply line from the ammonia receiver; the pressure of the condenser is also maintained automatically at about 175 pounds. The two low pressure circuits diverging from the ammonia receiver, in shunt with each other, converge into a common suction return at the compressor intake. As all the refrigerated boxes are in series and cooled by direct expansion, all stations are sympathetic to a rise in temperature at any one station on the line; hence a fixed ratio of temperatures always exists between the stations. A sensitive thermostat located in one of the cabinets near the suction end of the line acts as a master temperature control for the whole system, actuating through a relay switch, the motor control stopping and starting the plant

on a fall or rise in the temperature of a few degrees, maintaining practically a uniform temperature in each refrigerated chamber.

The whole performance of the plant and system is completely automatic, needing no manual attention except occasional inspection, oiling and wiping. No switches or valves are required to be opened or closed by hand; the plant starts to work and stops automatically, operating not a moment unnecessarily; its behavior is perfect on duty or in face of an interruption of electric power or water supply; the master thermostat automatically controls its hours of operation; an automatic pressure regulator gives an exact expansion to the refrigerant; the flow of the condensing water is controlled by an automatic water regulator which shuts off the water when the condensing pressure



Complete Electrically Operated Automatic Refrigeration Plant.

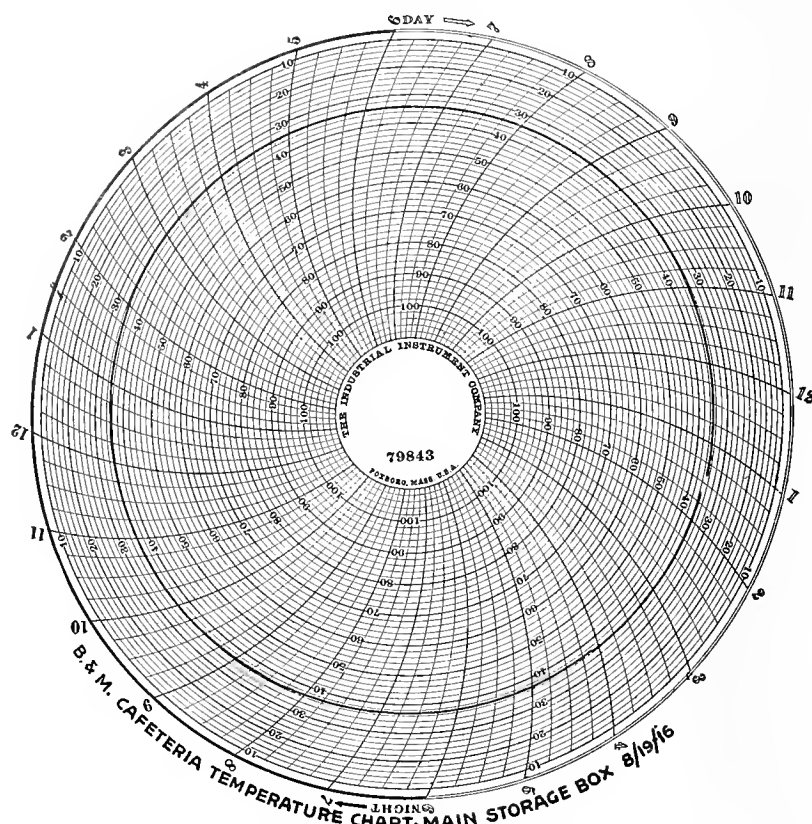


Chart Showing Temperature Variation in 24 Hours.

reaches a predetermined point shortly after the plant stops and turns on the water again when the pressure rises; in case of failure of the water supply to the condenser and consequent rise in pressure at ammonia condenser, an automatic high pressure safety regulator actuates an electrical cut-off shutting down the motor and when the water supply is renewed and ammonia pressure of condenser reduced to normal, this safety regulator cuts in and starts the motor.

The motor is a General Electric Company's standard squirrel cage type, three-phase, 220 volt, 1200 r.p.m. with friction clutch, pulley belted to the compressor through a counter shaft. The average consumption of the plant is 5.25 kilowatts per hour and the average time of operation, being the total of several operations daily, is 15.2 hours per day or 80 kw.-hr. per day. At least two and one-half tons of ice daily would be needed to furnish the equivalent refrigeration of this plant at present, and with ice at \$3 per ton the cost would be \$225 per month.

An offer was made by a local ice and refrigeration company, having an ammonia refrigeration system of distribution by pipes in the street, to supply the cafeteria with its service for a flat price of \$150 per month. The monthly cost to operate this plant by electricity, however, is about \$45 for current from the Southern California Edison Company. The other additional slight expenses when added would still keep the monthly operating cost below \$50. The further saving of electrical refrigeration as demonstrated by this plant, in time, labor, etc., more than offsets the fixed costs such as interest, depreciation, etc., on its investment. City water is used for condensing purposes, but as this is reused in the kitchen and boiler room, its first use for the cooling of the condenser,

therefore costs nothing; in fact, the heat imparted to this water is a distinct advantage and a saving rather than an expense.

Ten other motors for various power purposes are in use in this cafeteria, making a total monthly consumption of about 4800 kw.-hr., which according to the Los Angeles schedule of power rates earns an average rate of about 1.9c per kilowatt hour.

The electric range is not a seasonal proposition. Its autumn and winter sales will nearly reach its spring and summer sales if sound merchandising effort and cogent, consistent advertising is continued all year.

A large number of central stations, dealers and jobbers did not try to sell electric ranges from last October to April because the "electric range does not radiate heat and therefore everyone wants to cook on their coal or wood stove all winter." They were thinking only of the small town house with inadequate heating facilities.

On the other hand, other companies went ahead and sold ranges. But the majority of us talked the summer feature so often and so hard that we sold ourselves the idea. This is entirely wrong! Remember that gas ranges sell as well in the winter as they do in the summer.

Perhaps the electric range does not sell as easily in the small town during the winter as it does in the city where nearly every home has a modern heating system. But the fact remains that it does sell and that the sales depend entirely on the men and methods behind the campaign.

The right type of men produced electric light, the wireless and alternating current. And the right kind of a sales organization directed by a man with both head and go-ahead can sell carloads of ranges during this autumn and winter.

Keep up your range campaign! Keep taking advantage of this present period of prosperity! These are the best days of the whole year! Everyone is full of enthusiasm! Business is unusually brisk! Money is easy—in fact one-third of the country's annual wealth is put into circulation during harvest time!

Feature the electric range in your America's Electrical Week activities! Feature it in your Christmas campaigns! Establish a slogan "Give her an electric range for Christmas"—or one like it! Do anything but think that it has to be 103 deg. in the shade to modernize the cooking methods of your town or city! "Daisy Dayload."

Galalith is an insulating material made in Germany by treating casein with formaldehyde, the casein being obtained by the action of caustic alkali on skimmed milk. It is a bone-like substance resembling celluloid, but free from odor and not so inflammable. Its specific weight is 1.317 to 1.35 and hardness 2.5 (Mohs). It is never entirely transparent.

UP-TO-THE-MINUTE SELLING METHODS.

BY S. C. BRATTON AND G. D. MANTLE.

(This excellent paper received the gold medal at the recent convention of the Pacific Coast Gas Association at Santa Barbara, California. The authors are with the Portland Gas & Coke Company, Portland, Oregon.)

There is one easily applied test of the efficiency of your organization—ask the man in the street what he thinks of your company. Success depends entirely upon the good relations existing between corporation and consumer.

The most remarkable development in the history of the gas industry during the past decade has been, not in manufacturing methods but in the attitude of the individual companies towards their consumer. Ten years ago the adoption of "At your service" as a motto by the average gas company would have been little more than a poorly appreciated jest; today nearly every undertaking on the continent of North America has such a motto and endeavors to live up to it.

This development in the policy of all public service companies is almost paradoxical, for as their organizations have become more and more systematized their attitude towards the public has become more and more human with the consequence that the old opinion that any public utility company was little more than a legalized hold up gang is giving way and it is generally becoming recognized that it is our honest endeavor to give a full dollar's worth of service for every hundred cents expended with us by the consumer.

This improved condition can be traced to the time when the company officials began to realize that the consumer was not only "Meter No. so and so" but a human being whose good or bad will materially affected the figures on the annual balance sheet and who had therefore a very direct interest in the company's policy. This realization led to a closer analysis of local conditions and had two notable results: Better and fuller publicity; and the now almost universal practice of vesting the control of all public relations in one man who acts almost independently of the operating departments and whose duty it is to study all sides of the company's policy from the consumer's point of view.

In this paper it will be the endeavor of the authors to suggest means whereby a careful dissection of the impression gained from the consumers' standpoint can be utilized to develop a highly efficient sales organization. We are afraid therefore that those who from the title of the paper were led to expect details of a series of whirlwind campaigns and sensational advertising stunts will be disappointed. These have their place but they are not "Up to the minute selling methods."

The sales manager of today must take a broader view of his position than his predecessor of even ten years ago, he must realize that it is necessary to devote as careful attention to his field of labor as any husbandman to his, and it is now his object not only to reap in annually a goodly harvest of orders for gas consuming appliances but to clear and fertilize the ground from which the crop must spring.

Clearing the Soil.—His first object therefore should be to thoroughly analyze local conditions and

endeavor to remove all sources of irritation. Each consumer's attitude towards the company is determined solely by its policy as it affects him individually and the popular feeling can only be ascertained by conversing freely and frankly with consumers of all classes. Many sources of dissatisfaction can be traced by carefully watching the complaint file. Unfortunately it is too frequently our custom to allow complaints to go to the complaint department for attention without attempting to analyze and use them as a means of detecting conditions which should be remedied. Every complaint means at least a momentarily dissatisfied consumer and a dissatisfied consumer is at the best a poor revenue producer.

Systems of classifications of complaints will readily suggest themselves. A convenient method takes the form of a monthly report compiled from a card index posted daily by the complaint clerk. Cards are printed covering generally every source of complaint and these are filed under convenient headings. As each complaint comes in it is numbered and this number is placed on the card covering that particular complaint under the date received. The monthly report shows the number of complaints under each heading during the month and an unusual number leads to a careful investigation.

This system is not only a check on the company's own service but it is also one on dealers who do not exercise sufficient care in recommending and installing appliances.

Conversation with consumers may reveal another source of irritation which is impossible to remove without the closest personal supervision and the most careful selection of employees; we refer to the attitude adopted towards the public in departments other than the new business. This attitude is rarely if ever intentional but it shows a lack of knowledge of the most elementary principles that should govern the dealings of any servant of a public utility corporation with a consumer or prospective consumer. It must be borne in mind at every moment and under all circumstances that the individual consumer is per se the public at large and is entitled to the same consideration and respect as an authorized body representing all consumers.

The most agrant offenders in this respect are the employees of the collection and credit departments. We do not necessarily advocate any weakening of the credit or collection policy but we do urge that too close an investigation cannot be made before cutting off a consumer or turning down credit and that too much diplomacy cannot be exercised when such a course is necessary. An untactful remark or harsh letter may kill in a minute the good will built up by years of good service.

It is astonishing how many means of improving the service are suggested by analyses such as these, some will cost nothing and some may require a small expenditure which will be returned a hundredfold.

Fertilizing the Soil.—Having cleared the field of all sources of irritation the next step is to prepare and fertilize the ground. To do this it will be necessary to take the public more into the company's confidence than has generally been the case hitherto and

to make the man in the street feel that the gas company is not a body only to be dealt with because the same commodity cannot be purchased elsewhere but an institution with the public welfare, and his welfare in particular, always at heart.

A realization of this point by company officials and a systematic endeavor to gain the real friendship of every section of the community will not only redouble the returns of the new business department for the same expenditure of effort but will obtain the sympathy rather than the antagonism of the public for any contemplated change of rates or policy.

This preparation or fertilization can be accomplished in many ways the most effective being aptly termed "Goodwill advertising"; two fine examples of which will be fresh in the minds of all members.

The first to which we refer is the national magazine publicity of the American Telegraph & Telephone Company. It is not to be imagined that the expense of these advertisements was justified by the number of new connections influenced by them but there is scarcely a person in the United States who does not feel a kindlier interest in the company since reading them and who does not seriously doubt that any federally controlled organization could equal, much less surpass, the present system.

The second example which has a slightly different purpose is the series of advertisements of the People's Gas Light & Coke Company in the Chicago dailies. Everyone who reads them is bound to believe that the proposed change from a candle power to heat unit basis is in the interest of the consumer. A belief which we can scarcely conceive an uninitiated public would otherwise entertain.

These two examples are merely mentioned as showing the good results that can be obtained from skillfully handled publicity of this character and there is not the slightest doubt that a regular space in the local dailies with good attractive copy describing the work the company is doing in the interest of the public is an excellent investment. This space should always occupy the same position in the paper and a distinctive lay-out used. The minimum effective space is 18 to 20 inches and the advertisements should appear not less than twice a month. Get the best man in your city to write the copy, the additional expense is negligible when compared with the results and use different copy not only in every issue but in every paper.

Newspaper publicity though most effective is not the only way to prepare the ground. The human mind is a super-sensitive adding machine which automatically credits or debits to the goodwill account of every person or object momentary impressions, pleasant or unpleasant, made by that person or object. The senses chiefly affected are those of hearing and sight and when each employe of a company seizes every available opportunity to speak a courteous word and do a kindly action and the appearance of its offices and men are such that it is a pleasure to approach them, that company is due for a season of unprecedented prosperity.

Sowing the Seed.—The cleared and fertilized field should now be in ideal condition for the reception of the seed, in other words the implanting of a desire to

use gas in the minds of the people and as "the creation of a desire to buy" is almost an ideal definition of advertising our next step is clear.

Bearing in mind this definition of the word "advertising" it will be realized that the true advertisement is more than a mere announcement of a certain article at a certain price, which will as a rule only appeal to those who already have in some measure the desire to purchase and will leave untouched the far greater public in whom as yet this wish has not been created. The ideal advertisement appeals to every reader and endeavors to create a feeling that the comfort of the reader is not complete without the article advertised.

Though advertising is not as yet, indeed never can be, an exact science it is nevertheless a science and is in fact applied psychology, supported by a mass of statistics as complete as those used by a large insurance company in determining their risk; and just as the insurance company cannot say exactly what revenue the premiums of a certain number of policy holders will produce but know that in the aggregate they will produce a profit greater than the risk covered so the modern advertiser knows that though he cannot exactly foretell the result of a properly conducted advertising campaign, it will produce a revenue which will more than justify the expense involved.

With few exceptions the gas companies have failed to realize the value of press advertising, an omission which is doubly strange when one takes into consideration the fact that they are in a better position to profit by the sale of appliances advertised than the ordinary dealer, as the revenue from the gas consumed is more or less continuous and is not confined to one profit on the sale of the appliance itself.

A large proportion of the population of every town has but the haziest ideas concerning the cost of operation and advantages of even the commonest gas burning appliances yet cannot be reached by direct solicitation. The man and woman of today have, however, been educated to read the advertising columns of the daily papers and to realize that every reputable firm stands behind their announcements in the press. It would seem obvious therefore that a series of attractive advertisements discussing frankly the advantages and comparative cost of gas consuming appliances must create an interest which it would be impossible to stimulate in any other way.

The full benefit of press advertising can only be obtained by continuous effort, spasmodic announcement at infrequent intervals produce little or no results. Good copy writers are scarce and a good man is worth good money. The company therefore who delegates its advertising to the spare time of one of the clerks need not be surprised if the resultant inquiries are few.

The object of this paper is to stimulate interest in improved selling methods rather than to recommend any detailed policy and it is therefore not our purpose to consider the teachings of advertising. Those members however who desire to go further into the matter, will find much fascinating reading and more food for thought in Dr. Dill Scott's "Theory of Advertising" and Paul Terry Cherington's "Advertising as a Business Force."

Reaping the Harvest.—A properly conducted advertising department will treble the efficiency of the soliciting staff. The attitude of the public will change. Instead of regarding the solicitor as a more or less unwelcome intruder, the interest created by the advertisements will suggest questions which they will be glad to have answered and the salesman is relieved of the most difficult part of his duties, that of creating interest. There is not a man whose efficiency is not impaired for the rest of the day by a rebuff at a street door and he can now devote his time to real selling; reaping where the advertisements have sown.

Increased efficiency of the advertising department does not mean that less attention need be paid to the soliciting force, rather the contrary, for conditions are changing daily. The age of generalities in salesmanship is passed and prospective customers have now to be shown exactly how they will benefit by every dollar expended.

In the old days a man who had any experience in house to house canvassing of any description was eligible to fill a vacancy on the soliciting staff and was sent out with no more preparation than a few days on the salesroom floor and the information he could glean from a handbook consisting of sheets issued by a score of manufacturers. The results he achieved were due more to the fact that the appliances he sold were a necessity than to any expert salesmanship on his part.

Today our cities are more nearly approaching saturation point and the newer appliances have stronger competition to face than did the gas range. The consequence is that the gas salesman of today must compare favorably in training and address with those in any line of business, and though the subject is worn threadbare it may be worth while to consider for a moment the characteristics of the good solicitor.

Appearance.—His dress must be immaculate from crown to toe. The worst tempered woman will hesitate to shut the door in the face of a neatly dressed competent looking man while the very house dog shows his contempt for unshaven chins, soiled linen and baggy trousers.

Address.—Every woman is queen of the kingdom bounded by the four walls of her home and every man a king—when the queen is out. They therefore expect the greatest courtesy whatever their own attitude.

Stories of poor service must be listened to patiently and misunderstanding explained. Legitimate complaints should be at once reported to the office. More ill feeling is caused by the negligence of employes to report grievances after being requested to do so than by the actual source of complaint.

Control of temper should be a self-evident necessity in every salesman, yet frequently one salesman will remark to another that he had to tell so and so "where to head in" but we have never noticed so and so's order on the salesman's report sheet.

Belief.—The salesman who does not believe in, and would not himself use, the appliances he sells, had better change his line of business, he may have the finest arguments in the world but unless his heart

is behind his tongue the punch is lacking and a man with fewer wits but full belief will secure double the business.

Upon the sales manager lies the responsibility of seeing that his men are convinced of the advantage to the consumer of the appliances they sell. No good object can be attained by selling appliances to perform work for which they are inefficiently adapted and a salesman cannot know too much about the cost of operation and the results to be obtained under every condition.

Every solicitor should have at his finger tips the addresses in his district at which each class of appliance is operating satisfactorily and the average monthly bill. He should also be posted on cases of unsatisfactory operation and the reason for the consumer's dissatisfaction.

This information is one of the best weapons in the solicitor's armory. Mrs. Jones who is a prospect for an automatic water heater will be far more impressed if she is informed that Mrs. Smith, two blocks away, has been using a heater for twelve months, would not now be without one and that her average gas bill is \$4 per month, than if some purely hypothetical case were stated. If there has been an unsatisfactory water heater anywhere within a radius of a mile Mrs. Jones is certain to have heard of it but if the solicitor is aware of the facts he can explain to Mrs. Jones that the unsatisfactory operation of the heater was due say to the fact that the owner of the heater left the care of the house entirely to her maids and that hot water was running most of the day.

Knowledge.—The new salesman cannot too thoroughly understand that it is his object neither to sell an appliance as an appliance, nor gas as gas; but the work that the heat energy contained in the gas will do. He must understand therefore the nature of the work to be done and how the heat energy can be most efficiently utilized to do this work. A "British Thermal Unit" must be more than a technical term to him and become the very thing he sells, costing a certain sum and capable of a certain definite amount of work. He should know what specific heat is, what latent heat is, and the meaning of the simpler electrical terms.

He may be only a domestic solicitor but he should know the candle power, gas consumption and rates of commercial arcs should be acquainted with the more general industrial applications of gas and should have the company's credit and collection policy and tariff at at his finger tips.

The specializing solicitor requires even more careful training. The industrial man must know the properties of steam, the composition of the commoner alloys and a thousand and one other things. The lighting man must be able to calculate illuminating values and know the effect of glassware and the effect of various colored lights upon the eyes.

In addition to the regular solicitors every employee who comes in contact with the public is a salesman in potential and should receive a training which will enable him to talk intelligently of the various applications of gas and give rough comparative figures.

How can all this training be given without making serious inroads on the time of both manager and men? In the authors' case a system of bulletins has been the best answer to this question. These bulletins cover the company's credit policy, instructions on writing up orders, a short non-technical article on heat and one on every appliance handled by the company.

Each solicitor is provided with a binder in which to keep his bulletins which are conveniently numbered and replaced as they become obsolete. No excuse is accepted for lack of knowledge of any information contained in a bulletin and the consequence is that every man is instantly alive to a change of policy or prices and is at once conversant with the comparative advantages and costs of every new appliance introduced.

At the time each bulletin is issued to a solicitor an abbreviated form written in a non-technical manner is sent to every employe whose work brings him into contact with the public and is filed by him in his binder. The sales manager, or one of the specializing solicitors also attends the monthly meeting of the other departments and answers any questions arising from bulletins issued during the month. Credit is given to each employe who turns in a prospect form leading to an order and much friendly rivalry results.

Enthusiasm.—The greatest factor in building up a successful sales force still remains to be considered—enthusiasm. Without this, personality and training go for naught. If the men feel that the sales manager is a friend deeply interested in their success and welfare not only during but after office hours, if they can feel that he is there to guide and not to chide and if no trouble is too great to make a doubtful point clear enthusiasm is bound to result.

Conclusion.—As already stated our object has been to create thought rather than to recommend any definite sales policy and we believe that the sales manager whose efforts are based on the principles which we have endeavored to outline will benefit far more than if it had been in our power to suggest means whereby a record number of appliances could have been sold in a series of isolated campaigns.

Sales work is not confined to the sales department, every man in the company from president to office boy has but one object—to sell gas. If every effort is organized and all work to the same end success is easy, failure difficult.

We cannot point our moral better than by concluding with an old parable which probably few of us have heard for many, many years:

"Behold, a sower went forth to sow; and when he sowed, some seeds fell by the wayside, and the fowls came and devoured them up; Some fell upon stony places, where they had not much earth; and forthwith they sprang up, because they had no deepness of earth; And when the sun was up they were scorched; and because they had no root, they withered away; And some fell among thorns, and the thorns sprung up and choked them; But others fell into good ground and brought forth fruit, some an hundredfold, some sixtyfold, some thirtyfold."

"Who hath ears to hear, let him hear."

EFFICIENCY METHODS OF ANCIENT ROME.

The modern student in efficiency methods may well draw lessons from the ancients. Read the following from the writings of Cato, of ancient Rome:

When you have arrived at your country house and have saluted your household, you should make the rounds of the farm the same day. * * * When you have observed how the field work has progressed, what things have been done, and what remains undone, you should summon your overseer the next day and should call for a report of what has been done in good season, and why it has not been possible to complete the rest. * * * The overseer will report that he himself has worked diligently, but that some slaves have been sick and others truant, the weather has been bad, and that it has been necessary to work the public roads. When he has given these and many other excuses, you should recall to his attention the program of work which you laid out for him on your last visit and compare it with the results attained. If the weather has been bad, count how many stormy days there have been, and rehearse what work could have been done despite the rain, such as washing and pitching the wine vats, cleaning out the barns, sorting the grain, hauling out and composting the manure, cleaning seed, mending the old gear and making new. On feast days the old ditches should be mended, the public roads worked, briars cut down, the garden dug, the meadow cleaned, the hedges trimmed and the clippings collected and burned, and the fish pond cleaned out. On such days, furthermore, the slaves' rations should be cut down as compared with what is allowed when they are working in the fields in fine weather.

CENSUS STATISTICS FOR ELECTRICAL MACHINERY.

A preliminary statement on the manufacture of electrical machinery, apparatus and supplies has just been issued by the U. S. Bureau of Census. This statement presents a comparative showing of conditions for 1914 as compared with 1909, and is as follows:

	Census		Per cent of increase (1)
	1914	1909	1914
Number of establishments (2)...	1,030	1,009	2.1
Persons engaged in manufac-			
ture	144,712	105,600	37.0
Proprietors and firm members	368	439	—16.2
Salaried employees	26,266	17,905	46.7
Wage earners (av. number)	118,078	87,256	35.3
Primary horsepower	227,731	158,768	43.4
Capital	\$355,725,000	\$267,844,000	32.8
Services	109,097,000	69,574,000	56.8
Salaries	35,291,000	20,193,000	74.8
Wages	73,806,000	49,381,000	49.5
Materials	154,728,000	108,566,000	42.5
Value of products	335,170,000	221,309,000	51.4
Value added by manufacture (value of products less cost of materials)	180,442,000	112,743,000	60.0

(1) A minus sign (—) denotes a decrease.

(2) In addition, in 1914, 91 establishments, primarily engaged in other lines of manufacture, produced electrical machinery, apparatus, and supplies to the value of \$24,261,961, and in 1909, 142 establishments of this character manufactured \$18,728,916 worth of electrical machinery, apparatus, and supplies as a subsidiary product.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Inducing the consumers of public utility service to become financial partners in the enterprise is a movement which has made considerable progress during the past year.

* * *

The shortage of copper in Germany has caused the use of zinc and steel conductors to have a wide application for the conveyance of electrical energy in that country.

* * *

Capital has been subscribed at Phoenix and at Tucson to manufacture rubber of the sap of guayule and ocatilla, desert plants peculiar to southern Arizona. The same plants are found in Texas and northern Mexico.

* * *

There are now being built in the Pacific Northwest thirty-seven ships with a tonnage capacity of 292,000, of which number eleven are wooden vessels of the class of semi-Diesel auxiliary power propellers, with a tonnage of 77,000.

* * *

"Once a week call the bunch together and talk over the things that are not wrong." This was the philosophy of James J. Hill. It ought to be just as applicable to affairs electrical as it proved effective in empire building.

* * *

The War Department is offering an opportunity to members of the various engineering societies to obtain commissions in the engineer corps. Commissions will be issued for the grades of major, captain, first and second lieutenants.

* * *

The price of gasoline in the British Isles has risen to the unheard of figure of seventy-three cents per gallon. This accounts for the fact that California producers are now shipping gasoline via the Panama Canal at considerable profit.

* * *

The largest boilers ever installed in America have just been put into operation by the Ford Motor Company. Each boiler has a heating surface of twenty-five thousand square feet and covers a floor area of nearly four hundred square feet.

* * *

With its more than a quarter of a million miles of railroads the United States not only leads every other nation in the world, but exceeds by 50,000 miles the total railway mileage of Europe. In fact it has two-thirds as much as all the rest of the world combined.

* * *

The classic horse-drawn street sprinkler with rear end spout is now to be replaced by electrically propelled vehicles with the sprinkler heads in front, this arrangement giving the driver better control and understanding of the requirements of the moment than when the sprinkling apparatus is out of sight.

Establishing the harbor line of Lake Washington in Seattle by means of photographs taken from a biplane is the latest advance in commercial possibilities of aeronautics which is being accomplished by engineers in the Northwest.

* * *

The possibility of photographing objects at a distance of several miles by means of a moving picture camera has been investigated by the United States Bureau of Standards. For this purpose a camera of great focal length was constructed. It was found possible to take pictures of objects at a great distance.

* * *

Electric purification of water in swimming pools is becoming popular. The water entering the pool is passed through a battery of filters and then conveyed to the top of a beautiful cascade, where an ultra-violet ray sterilizer is located which exterminates any germ life while the water is passing through the ultra-violet rays.

* * *

The term photo-electricity is applied to the phenomenon which is observed when a beam of light is permitted to fall upon certain substances which are negatively charged with electricity. If the conditions are properly chosen, it is found that such substance, regardless of ordinary leakage, will gradually lose its electric charge.

* * *

Wild burros, descendants of stock left behind when Coronado, the Spanish explorer, crossed the Southwest from Mexico, in 1545, have increased in such numbers, in the Grand Canyon of Arizona, in recent years, that they have become a nuisance. Even if the jitney should become extinct Arizona ought never to lack transportation facilities.

* * *

The Roosevelt dam, head of the Salt River Valley Reclamation Project, abounds with game fish. Bass, planted there by the United State Government since the reservoir began to fill with water, have multiplied many thousandfold, and there are crappie, salmon, perch, and trout beside. In the shallows, soft-shell turtle and carp abound. Land-locked salmon in this lake, very like the Scotch variety, often are caught three feet long.

* * *

The growing scarcity of materials for the manufacture of paper has led the Bureau of Science of the Philippine Islands to make public some important data concerning the supply of such materials in the islands. For several years the bureau has been investigating the suitability of bamboo, cogon grass, abaca, and various palm fibers for paper pulp. The facts collected are regarded as evidence that an industry of great economic value could be developed. It would seem that certain Pacific Coast States could well undertake similar investigations.

JOURNAL OF ELECTRICITY

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Many convincing arguments may be forcefully advanced in favor of cooking and baking by electrical means. The cleanliness, economy, and food saving resulting from such methods are strong points in the mental picture to be painted before the vision of the prospective purchaser. But the argument that sweeps everything before it, when properly and carefully set forth, is the perfect ease of temperature regulation that is possible to the electrical method and not possible to such a degree of perfection in any other known means of heat application.

This all-sweeping point in favor of the electrical method can not be too strongly emphasized. Not only is it true in ordinary cooking, but in the delicate variation in temperatures needed in baking, electrical control becomes especially advantageous.

Passing from domestic devices wherein heat applications are necessary to those where heat abstraction is desired, recent advances in electrical refrigeration again place the method electrical far superior to all other known systems.

The description to be found on another page of this issue setting forth the details of a recently installed refrigeration plant, in the largest cafeteria in existence, which is located in Los Angeles, is especially interesting at this period of intense campaigning for "Do it electrically."

To properly preserve different foods in color and flavor a delicate regulation of temperature is absolutely necessary. Not only is this true, but different temperatures are required for different foods. Thus it is found that fish is best preserved at 33 degrees F., berries at 38 degrees F., and meat at 40 degrees F.

For such a delicate feat as this, ice proves thoroughly unsatisfactory. It can not maintain the temperature required, and the ice boxes prove humid, clammy and unsanitary, to say nothing of the increased cost necessitated.

And finally the delicate control of temperature both at individual refrigerator boxes and at the master regulator makes the electrical method ideal in operation.

This delicate control to be effected by electrical applications has long been recognized in the industries—especially in furnaces where the electrical method has become so popular. In the melting of ores, in the manufacture of gas and countless other applications this strong point is also acknowledged as having been of prime importance in leading the management to adopt the electrical method.

The domestic world has scarcely as yet been fully and forcefully advised of this convincing argument for household uses of electrical energy. The traditions of a thousand years have so implanted conservatism in the household breast, so far as breaking away from time honored methods of cooking by fire as did our ancient ancestors is concerned, that the uprooting of this idea has proved exceedingly difficult.

But the beautiful and perfect regulation of temperature control possible in electrical applications of heat when once painted upon the vision of the housekeeper can never be erased. This is a psychologic point winner. It is correct in theory and awaits practical emphasis alone to place the electrical method

of doing things upon a plane from which it will never recede.

Much is being said in these days of expansion in commercial ideals as to the possible commanding position American industry and manufacture will from now on assume among the nations of the world. Looking beneath this rather glittering array of possibilities, however, even the casual investigator finds much for serious reflection.

In the district west of the Rocky Mountains, engineers and others engaged in constructive and commercial activities have long been aware of the fact that vast opportunities await them for intercourse with neighboring countries of the Pacific. The releasing or liquidating of heavy securities, formerly held by European investors, has now placed American credit in such shape that financial aid for reasonably sound investments in the countries may be expected.

The development of the natural resources of these countries will of course call for the advancing of credit and from this will follow an exodus of American engineering and constructive talent from our Pacific Coast shore to these various countries.

Some little discussion has in recent months taken place in financial and commercial papers of national repute warning Americans to verse themselves in the language, customs, laws and methods of doing business in various foreign countries before hastily engaging themselves for foreign enterprise.

An engineering problem that will prove extremely perplexing which has not as yet received much discussion is that of the almost complete lack of standards in construction that will be encountered—especially in hydroelectric activity. Few countries have advanced in standardization methods to the heights at present prevalent in America.

Take for instance our Western hydroelectric networks. So standardized and so centralized has this development become, even over connected distances of six hundred miles, that continuity and economy of service are almost ideal. On the other hand compare conditions with those existing in London, the most populous city of the world. In that great city according to a well known authority, there are some seventy-nine power stations, forty-nine systems of generating, ten frequencies, thirty-two generated voltages, twenty-four distributing voltages and seventy methods of charging. Imagine such chaotic standardization existing in America! What would Ashville, N. C., have done in the recent destructive floods if power plants of Alabama, Georgia and Tennessee could not have tied in immediately?

Then there is the confusion in gauges of rails. In the great republic of Argentina where railroads rival in many instances the mileage and constructive beauty of those in the United States, there exist today a dozen different standard gauges. One American state, that of Pennsylvania, went on record against standardization by passing a law some sixty years ago that all railroad companies within its borders must have a different gauge. In those days, people feared that rolling stock might wander out of sight and lose itself. Today American ideals have vastly broadened.

We should all continue to preach this gospel of

standardization. We can well begin missionary work at home by putting into practical application the metric system in which other nations have advanced much further than we. At the same time the hundred other standardized international needs which are now so commonly adopted in the United States might well be propagated among our foreign neighbors with whom we will undoubtedly become so well-acquainted in the near future.

Some two years back a well-known Pacific Coast sales authority forcefully called the attention of the San Francisco Electrical Development League to the fact that too many electrical men wasted their time in trying to take business

Electrify Your Talk

away from a competitor rather than by looking afield for new business outlets and thus creating new energizing activities not only for themselves in particular but for the electrical fraternity as a whole. This is real constructive salesmanship. Since that epoch making period when co-operative electrical development was in its infancy, the electrical fraternity has advanced by leaps and bounds. Today a nationwide campaign is being fostered for the promotion of a gigantic co-operative sales effort during the first week of December, the event to be known as America's Electrical Week.

To make this mammoth electrical event realize the fullest possible returns in the West, the people throughout the length and breadth of this section of the country must be individually brought in touch with this great work. It is not enough that a poster campaign setting forth the wonders of the modern electrical Aladdin should be scattered broadcast throughout the homes of America in some six million reproductions. It is not enough that shows and parades should be instituted in hamlet and city to display electrical enthusiasm and accomplishment. It is not even enough that advertisers on all other subjects should during this period interweave electrical features to assist in this campaign. The greatest good is to be accomplished during this week by making the actual transference of speech partake of electricity and its wonders. In short the pass-word of the week should be to neighbor and customer alike, "Electrify your talk."

Make your games and hours of relaxation partake of electrical tinge.

In the operation of the household as far as possible electric lighting, heating, cooking, sewing, washing, ironing and cleaning should be encouraged to the fullest extent. The up-to-date home is electrical. So are the up-to-date offices and stores, farms and factories. Let the conversation dwell on these facts.

It is an old axiom that a hobby ridden too often in conversation becomes tiresome to the listener. This is not true in this instance. With the ever widening uses and beauties of electricity and its applications the theme is infinite in variety. It is impossible of exhaustion or wearying.

Finally, then, let each charge himself with the subtle thoughts that flash forth intelligent descriptions of the wonders of the modern Aladdin—in a word, during America's Electrical Week "Electrify your talk."

PERSONALS

H. A. Cortwright, of the Valley Electric Supply Company of Fresno, was a recent visitor at San Francisco.

W. I. Otis and L. E. Sperry, manufacturers' agents of San Francisco, are making a few weeks' business trip to Los Angeles.

J. H. Newland, purchasing agent of the San Joaquin Light & Power Corporation of Fresno, was a recent visitor at San Francisco.

M. E. Hickox, salesman with the Pacific States Electric Company at San Francisco, has returned from a vacation at Santa Barbara.

Paul B. McKee, assistant to the president of the California-Oregon Power Company, has returned from a short trip to Santa Cruz.

J. P. Bell, Pacific Coast manager Standard Underground Cable Company, has returned to San Francisco from a week's trip to Los Angeles.

F. W. Gay, formerly chief engineer of the J. G. White Company at San Francisco, is now the Pacific Coast correspondent for that company.

W. P. Strandborg, advertising agent for the Portland Railway, Light & Power Company, has returned from a trip to Denver and Colorado Springs.

B. J. Klein, Pacific Coast manager of the Bristol Company of Waterbury, Conn, is making a four weeks' business trip throughout the Pacific Northwest.

Dave Mason, district manager of the Midland County Public Service Corporation of San Luis Obispo, spent a few days this week at San Francisco.

George C. Mason, civil engineer and vice-president of the Hurley-Mason Company, has been elected a member of the Portland Civil Service Commission.

F. T. Van Atta, chief electrician of the Northwestern Pacific Railroad Company, left San Francisco for an extended trip throughout the East last week.

W. W. Briggs, general agent Great Western Power Company of San Francisco, will return from a ten days' business trip to Salt Lake City next Monday.

C. M. Clark, chairman of the board of directors of the Portland Railway, Light & Power Company, was at Portland during the past week from Philadelphia.

C. F. Conn, formerly manager of the San Francisco office of the J. G. White Company, has recently returned to the New York offices, where he will be permanently located.

R. F. Behan, assistant to manager of the Westinghouse Electric & Manufacturing Company at San Francisco, has returned from a two weeks' vacation at Siegler Springs, in Lake County.

Jas. F. Fenwick, assistant manager of the Hawaiian Electric Company, Ltd., of Honolulu, who has been visiting San Francisco for the past few weeks, left for the islands on Wednesday of this week.

S. E. Gamble, formerly of the Great Western Power Company of San Francisco; H. B. Kinney, formerly with the H. M. Byllesby Company, and W. H. Early have recently taken over the Appliance Manufacturing Company of San Francisco, and have established their factory and offices at 561 Howard street.

Carl J. Rhodin, formerly chief civil and hydraulic engineer for the J. G. White Engineering Corporation at San Francisco, is now in private practice with offices in the Alaska Commercial building, San Francisco. He has made valuation of nearly all the large hydroelectric power systems in Cali-

fornia, also working on design and construction, and is now retained by the Sierra & San Francisco Power Company.

H. F. Jackson of San Francisco, has been elected president of the Sierra & San Francisco Power Company, J. K. Moffitt first vice-president, P. M. Hoskins of New York second vice-president, and F. J. Blanchard of San Francisco, secretary and treasurer, at the annual meeting last week. The former board of directors was re-elected. Announcement was made that \$1,000,000 additional in bonds had been sold and the proceeds would be applied to new construction.

W. M. Shepard, commercial manager of the California-Oregon Power Company, is making a tour of inspection throughout Northern California and Southern Oregon. The Klamath River Dam No. 1 is being rushed to completion before winter sets in. There are now 250 men on the job. There seems to be decided activity shown in the mining district in Southern Oregon, and their 60,000 volt line running between Castella and Carville is now ready and furnishing current to the Yukon Gold Dredging Company.

MEETING NOTICES.

San Francisco Electrical Development & Jovian League.

The annual meeting and election of officers of the league was held at the Palace Hotel, 12:15 p. m., with President E. M. Cutting presiding.

The minutes of the preceding meetings of the year were adopted as a whole, as was also the treasurer's report showing a balance on hand as of October 10, 1916, of \$418.78. H. V. Carter, chairman of the finance committee, called particular attention to the matter of prompt payment of dues and suggested active work be done among the members along this line. The report of the nominating committee, appointed at the September 30 meeting, was submitted as follows:

L. H. Newbert.....	President.
R. M. Alvord.....	1st Vice-President.
R. E. Fisher.....	2d Vice-President.
C. E. Wiggin.....	Executive Committee.
H. H. Hoxie.....	Executive Committee.
J. W. Redpath.....	Secretary-Treasurer.

This report was unanimously accepted and the secretary instructed to cast the ballot for nominees. A vote of thanks was tendered the retiring officers and complimented for their work during the past year. The newly-elected President, L. H. Newbert, was conducted to the chair and conducted the concluding part of the meeting.

Los Angeles Jovian Electric League.

The regular weekly luncheon was held October 11th, at Jahnke's Tavern, with the honors to W. L. Frost, assistant to the general agent of the Southern California Edison company, as chairman of the day. A. H. Halloran was speaker of the day and delivered an address on the subject of "A Greater Jovianism." He complimented the League on the excellent work done during the past year and lauded the spirit of co-operation and loyalty that has kept the League well to the front on the coast. As Pacific Coast representative of the Society for Electrical Development he explained the aims and purpose of America's Electrical Week and urged the electrical men of Los Angeles to participate actively. The following officers were elected for the coming year: President, A. E. Morphy, Southern California Edison Company; first vice-president, K. E. Van Kuran, Westinghouse Electric & Manufacturing Company; second vice-president, Carl Young, Illinois Electric Company; secretary and treasurer, Clifton Peters, Southern California Edison Company; board of directors, Thos. Foulkes, W. S. Gibbs, C. M. Bliven, E. R. Northmore, R. H. Manahan, C. B. McLean. The growth of the League during the past year, the active membership of which now numbers 305, is directly due to the efforts of President C. A. Holland and his officers and directors and a fast pace

has been set for the coming year. Retiring president Holland spoke especially of the assistance rendered by H. N. Sessions, chairman of the paper committee, and Carl Young, chairman of the press committee. A hearty vote of thanks was given the retiring officers for their untiring work in the league's behalf.

Portland Sections of A. I. E. E. and N. E. L. A.

The first regular joint meeting of the Portland section of the American Institute of Electrical Engineers and the National Electric Light Association, was held at the Estacada Hotel, Tuesday evening, October 10, 1916. A special train left First and Alder streets at 5:30 p. m. with 123 members and guests. Immediately upon arriving at the hotel a special dinner consisting of chicken and salmon trout was served.

L. T. Merwin acted as chairman. The chairman of the various committees outlined their work for the year; after which a vocal solo was rendered by Henry S. Coughall, accompanied by J. R. Davies.

In order that O. B. Coldwell, "President of the Jitney Drivers' Union," would not fail to get an opportunity to present his carefully prepared address, Mr. Merwin called upon him as the first speaker of the evening. His subject was "Why the Jitney Should Not Be Regulated." His views met with general approval, and the Estacada Band (Henkle's) appeared upon the scene and serenaded Mr. Coldwell.

E. F. Whitney, General Electric Company, made a stirring appeal for the use of "Kerosene instead of Mazda Lamps." As the fall election is drawing near, it was thought advisable to have some speeches on the various issues of the day by prominent and well-informed candidates. A. S. Moody, vice-president and manager Pacific States Electric Company, spoke for prohibition. W. H. Galvani, Pacific Power & Light Company spoke on Socialism. E. R. Lundburg, a prominent Democrat, spoke on "Why Mr. Hughes should be elected." J. H. Lang, counsel for the Pacific Light & Power Company, a Republican, spoke on "Why Woodrow Wilson should be elected."

W. D. Scott, Pacific Telephone & Telegraph Company, was called upon to tell why everyone in Portland should use Home telephones. Also Mr. A. C. MacMicken told the meeting why they should use gas for cooking, and Mr. Geo. G. Bowen, Northwest Electric Company, told "Why a sales manager should not know anything about the business."

The first meeting of the semi-monthly luncheon club of the Joint Sections of the A. I. E. E. and the N. E. L. A. and the Oregon Society of Engineers will be held at noon October 25th in the orange room of the Oregon Hotel, Portland, Oregon. The program of the day will be arranged by the Pacific Power & Light Company.

The second regular joint meeting of the Portland sections will be held at 8 o'clock Tuesday evening, November 14, 1916, at the Electric Building, Portland, Oregon.

U. S. CIVIL SERVICE EXAMINATION.

The United States Civil Service Commission announces an open competitive examination for expert electrical and mechanical aid to fill a vacancy at \$12.48 per diem, in the Bureau of Yards and Docks, Navy Department, Washington, D. C. The duties of this position cover the expert maintenance and supervision of the operation of all navy-yard power plants, embracing the economical production, distribution, and utilization of electric power for manufacturing, pumping dry docks, charging submarines, and for ships undergoing repairs; compressed air for manufacturing; steam for power and central heating, and production and distribution of hydraulic power; also investigations of power-plant operating conditions, tests of plants and equipment, and efficiency engineering work in connection with improvement of operating conditions and instruction of plant operatives to obtain economical operating results. The appointee will give expert advice upon, and will

be held responsible for, the design of new projects for the economical production of power, in which will be included pumping plants for dry docks, power plants and distribution systems for experimental laboratory, projectile plant, armor plant, equipment for supplying power to radio stations, heating and lighting equipment for various prospective public works, such as hull-construction shops, foundries, machine shops, barracks, storehouses, offices, etc.; also upon the design and layout of extensions to present plants to provide for prospective expansion of yards and stations and the remodeling of lighting systems in existing buildings and shops.

Competitors will not be assembled for examination, but will be rated on technical education (40 points); experience and fitness (60 points). Graduation with a degree of mechanical engineer or electrical engineer from a college or university of recognized standing, and at least ten years' subsequent experience in responsible charge of the design, installation, and operation of central power plants and distribution systems for light, heat and power with executive experience in handling successfully large numbers of power-plant employees, are pre-requisites for consideration for this position. Additional credit will be given candidates who have had special experience in connection with the power and operating requirements for radio work.

PUBLICATIONS RECEIVED.

The Nitration of Toluene, by E. J. Hoffman, has just been issued as Technical Paper 146, by the Bureau of Mines, Department of the Interior.

Technical paper 116 of the U. S. Bureau of Mines deals with subjects concerning safe practice at blast furnaces. It is in the nature of a manual for foremen and men.

A new publication of the Bureau of Standards (Circular No. 60) entitled "Electric Units and Standards," gives comprehensive and up-to-date information regarding the units and standards in terms of which electric and magnetic measurements are made. It includes the history of the units and the evolution of the definitions upon which the laws on electrical standards are based. The laws of this and other countries are given. These laws are in substantial agreement, and the various national bureaus of standards co-operate in maintaining the fundamental standards. The circular gives conversion factors, by means of which measurements may be expressed in any desired unit. The information on electric units and standards had not previously been available in a single publication.

NEW CATALOGUES.

The Sprague Electric Works of the General Electric Company has just issued Bulletin No. 48707 on direct current motors and controllers for job presses, folders and book-binding machinery.

The Dearborn Chemical Co. of New York send a well illustrated pamphlet of thirty-two pages on incrustation, corrosion, foaming, and other effects of water used in steam making together with methods of prevention.

Hughes Electric Bake Ovens is the subject of an interesting pamphlet from the Hughes Electric Heating Company. Besides giving complete information on the Hughes lines it presents arguments and cost data on electric baking in general.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The Meadows Light & Power Company has been ordered by November 5, 1916, to report to the commission a plan for the extension or enlargement of its present hydroelectric plant sufficient to furnish electrical energy to meet present and reasonable future demands.

NEWS OF CALIFORNIA WATER COMMISSION.

The Oak Spring Water Company of Victorville has applied for permission to appropriate 3 sec. ft. of the waters of Oak spring in San Bernardino county for agricultural purposes. The plans propose a dam 50 ft. high, 160 ft. on top and 20 ft. on bottom, with clay core, with sand fill front and back, core to be 4 ft. thick to top of dam, also a pipe line $6\frac{1}{2}$ miles long. The estimated cost is \$5,000 and the number of acres to be watered, 200.

...The James Mills Orchards Corporation and the Esperanza Land Corporation of New York have applied for permission to appropriate 20 cu. ft. per second of the waters of Stone Corral creek, tributary to Colusa basin in that county, for purposes of agriculture. It is proposed to lift the water by means of pumps for the irrigation of 4,823 acres of land.

Robert Cords Jr. of San Francisco has applied for permission to appropriate for agricultural purposes 20 cu. ft. per second of the waters of Avenal creek in Kings county, the request being for the storm or flood waters of said creek. At a cost of \$1,500, and by means of a ditch a mile in length, applicant intends to bring water to 640 acres.

Webb Bros. Company of Yreka have applied for permission to appropriate for agricultural purposes, 12 cu. ft. per second of the waters of Shasta river, tributary to Klamath river in Siskiyou county. The plans propose a canal and pipe line 4 miles long, the water to be diverted to a sump and raised 95 ft. and thence to the lands by pipe and ditches. The number of acres proposed to be watered is 1,200 and the estimated cost is \$20,000.

May E. Ivory of Alturas has applied for permission to appropriate for irrigation, 1,550 acre feet per annum of the waters of the Antelope Plains drainage area, tributary to Pit river. The estimated cost is \$2,400 and the number of acres to be irrigated, 675.

The city of Arcadia has applied for permission to appropriate for municipal purposes the waters of Big Santa Anita creek and its tributary, Clamshell creek, to the extent of 6 cu. ft. per second. In the proposed works there is a 16-in. pipe line 1,232 ft. long from Big Santa Anita creek, which joins with a 6-in. pipe line 1,395 ft. in length from Clamshell creek, thence a 16-inch pipe line 10,988 ft. long to place of use. The water is diverted by means of two boulder concrete dams, and the estimated cost of the works is \$25,000.

William L. Wales of Woodland has applied for the proposed Honey Lake district, to appropriate 200 cu. ft. per second of the waters of Butte creek and a like amount from Horse lake, both diversions being in Lassen county. No data is given in regard to the project, with the exception that it is proposed to irrigate 40,000 acres.

The Mono Canal Company has applied for permission to appropriate 750 cubic feet per second of the waters of Rush and Lee Vining creeks in Mono county, tributary to Mono Lake. No data are given in regard to the engineering phases of the project except to maintain that there is a canal 30 miles long. The application states that it is proposed to irrigate 50,000 acres at an estimated cost of \$500,000.

D. M. Eckhard and P. B. McBride of Davis Creek have applied for permission to appropriate 175 acre feet of the waters of Parker Flat Canyon, tributary to Geese Lake in Modoc county. A main ditch $2\frac{1}{2}$ miles long is proposed to carry the water to 110 acres of land at an estimated cost of \$2000.

The City of Los Angeles Public Service Commission has applied for permission to appropriate 10 second feet of the waters of Cartage Creek in Inyo county. The proposed diversion relates to one of the units of the power scheme of the city of Los Angeles. The application sets forth that the applicant proposes to divert the water into the Los Angeles aqueduct 232 miles long, by means of a concrete flume and gives the estimated cost of the power and aqueduct plants at \$33,000,000.

The Lucerne Water Company of Montague, Siskiyou county, has applied for permission to appropriate 50 cubic feet per second of the waters of Shasta River tributary to Klamath River for irrigating 5000 acres. A dam is proposed to back the water into a sump. A pumping plant at the dam will elevate 70 ft. above the river through a 40 in. pipe. For the main lift there is proposed a 20 in. pump driven by a 300 h.p. motor, and for the secondary lift a 12 in. pump operated by a 200 h.p. motor. The water will be carried thence 720 ft. through a pipe line and a flume 1170 ft. long to the main ditch. The estimated cost of the project is given as \$50,000.

Eugene Rutherford of Butte county has applied for permission to appropriate for irrigation purposes, 10 second feet of the waste waters flowing into Stone Slough, tributary to Hamilton slough. The main ditch as proposed, is to be 12,736 ft. long, and the number of acres of land it is proposed to irrigate is 880.

R. Whitehead of Oakland has applied for permission to appropriate 150 cubic feet per second of the waters of Plumas Lake and Feather River, tributary to the Sacramento River, for the purpose of raising rice and other agricultural products. The proposed diversion is in Butte county. A main canal 3 miles long is a part of the works, the only data given in the application on the engineering phases. Complete maps will have to be prepared before the application can be further considered by the commission. The estimated cost of the project is given as \$50,000 and the number of acres to be watered as 6309.

Ed. Ivory of Alturas has applied for permission to appropriate 893 acre feet of Ryegrass Swale and tributaries, tributary to Canyon Creek in Modoc county. A main ditch 1250 ft. long is proposed to carry the water to 663 acres at an estimated cost of \$2200.

NEWS OF ARIZONA CORPORATION COMMISSION.

The Navajo-Apache Telephone System of Holbrook, Ariz., has been granted permission to change its toll rates in accordance with schedules submitted by the company. In the proposed schedule, all arbitrary rates are abandoned and the system is put upon an air mile basis, with a rate of one cent per air mile for five minutes' conversation; the result being that many of the present rates will be reduced by amounts varying from five to fifteen cents, and several will be raised five cents.

On or before November 20, 1916, the Desert Power & Water Company has been ordered to file with the commission a complete and detailed statement showing the value of its property, tangible and intangible, devoted to serving its consumers with electricity. This statement shall contain an inventory of its property with quantities and values set forth in such a way that same may be checked from an examination of the property and records of the company.

BOOK REVIEWS.

Electrical Engineering. By Ernst Julius Berg, Sc. D. Size 5 in. by 9 in.; 332 pp.; 163 illustrations; cloth binding. Published by the McGraw-Hill Book Company, Inc., of New York and for sale at the Technical Book Shop, San Francisco. Price \$3.50.

This is an advanced course in electrical engineering. The book is based upon the subject matter contained in a series of lectures given to graduate students in electrical engineering at Union College where the author is professor of electrical engineering. The book largely aims at setting forth the mathematical deduction of equations representing alternating current phenomena, such as the building up of currents in a wire and transient phenomena connected with it, as well as many other problems of higher mathematical analysis. The method of approach is clear and logical. To students of advanced reasoning of this nature, the book will prove of great value.



NEWS NOTES



ILLUMINATION.

WEISER, IDAHO.—Sayer & Record have been awarded the contract for installing the new electric light plant at Arco, Idaho, which was provided for by a recent bond issue.

SANTA BARBARA, CAL.—Metal ornamental light standards have been decided upon for State street by the city council. The plans provide for ten posts to the block.

SUNNYSIDE, WASH.—The Pacific Power & Light Company is to install 14 new 4000-candlepower lights in the business district and 41 100-candlepower lights in the residence district.

LOS ANGELES, CAL.—The city council has ordered an ordinance of intention prepared providing for the ornamental lighting of Washington street, between Main street and Central avenue.

POCATELLO, IDAHO.—Bids will be received by the City Council until October 26th for the construction of an incandescent street lighting system in Local Street Improvement District No. 15.

KLAMATH FALLS, ORE.—The granting of a franchise to the Reno Power Company of Reno, to furnish light and power to this city will be submitted to the people at a special election on November 14th.

FRESNO, CAL.—Fresno county will erect its own lighting system for Court House Park. Several weeks ago the supervisors advertised for bids. The lowest received was \$13,987, and all bids were rejected.

SACRAMENTO, CAL.—The board of supervisors has called for bids for furnishing electricity and necessary equipment for lighting approximately thirty-five 400-candlepower series of Mazda lamps, for a period of five years.

BREMERTON, WASH.—The mayor has vetoed the proposed franchise for the gas plant here, which was granted to E. L. Blaine, of the Graff Construction Co., Seattle. This would have called for the expenditure of \$150,000.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to November 6th for the installation of an electrical system in various buildings to be erected on the grounds of the Los Angeles County Hospital.

CHLORIDE, ARIZ.—J. E. Terral of the Chloride Electric Supply Company, states that he has wired 250 houses in an anticipation of the early arrival of electricity. A line is to be brought here by the Desert Power Company.

CLE ELUM, WASH.—Bids will be received by the town of South Cle Elum until November 6th, for the purchase of \$5000 worth of bonds, the money to be used to partially pay for the construction of a municipal electric light plant.

DOUGLAS, ARIZ.—Assessment rolls for the ornamental lighting system to be installed in the G avenue and Tenth street district have been completed by the city engineer. The exact cost of the system for the district will be \$12,543.76.

LOS ANGELES, CAL.—The board of public works has let the contract for the installation of lighting posts and appliances on Hollywood boulevard between Cherokee avenue and Wilcox avenue, to the McEwan Electric Company, on its bid of \$2096.

LOS ANGELES, CAL.—Improvements to cost \$356,789 are planned by the Southern Counties Gas Company it has been announced. The contemplated work embraces the completion of the Pomona-Brea line and an additional transmission main between Whittier and Monrovia.

LOS ANGELES, CAL.—The lighting problem of Athens-on-the-Hill will be terminated when the board of supervisors

make an order to the effect that an ornamental lighting system be installed in the district west of Main street and that the district which opposed this form of street light, namely east of Main, will have arc lights.

TRANSMISSION.

NELSON, B. C.—It is reported that the directors of the Utica mine will install a power plant.

OAKDALE, CAL.—The Sierra & San Francisco Power Company has purchased two lots on F street and will erect a substation.

MOORE, MONT.—The electrical system of this place is to be reconstructed in the spring according to the local representative of the Montana Power Company.

KINGMAN, ARIZ.—Bids are being received at the Oatman office of the Oatman Revenue Mines Company for the erection of a power plant, head frame and camp equipment.

SAN FRANCISCO, CAL.—The City Electric Company has awarded the contract for the erection of a substation building on Bush street near Grant avenue, to G. O. W. Jensen for \$37,800.

COEUR d'ALENE, IDAHO.—The Central Heating & Electric Company has been incorporated by F. D. Warn, et al., to utilize the franchise recently granted by this city to Wm. Dollar.

MELSTONE, MONT.—H. A. Amberg has been awarded the contract for constructing the generator room of the municipal electric light plant. Bonds to the amount of \$8000 were sold for this purpose.

SUNNYSIDE, WASH.—An ordinance has been passed by the council granting the Pacific Power & Light Company permission to construct and operate power lines supplying electricity to the town of Sunnyside.

FOREST GROVE, ORE.—Application for a franchise by the Portland Gas & Coke Company to lay mains here has been made. It is understood that the company proposes to ask a franchise for laying mains in the county also.

BAKERSFIELD, CAL.—The Southern Sierras Power Company has been awarded a franchise to erect and maintain for 50 years an electric pole, tower and wire system, along the public highways in certain portions of Kern county.

QUINCY, CAL.—The Walker Mining Company of Salt Lake City has applied to the state water commission for permission to appropriate 20 cu. ft. per second of the waters of Ward and Nyo creeks in Plumas county for power purposes, used in mining and milling.

MILTON, ORE.—J. E. Shipp, of North Yakima, chief construction engineer of the Pacific Power & Light Company, has arranged to start work on reconstruction of the flume of the company here. This is a 7-mile open wood affair and will be replaced with concrete. The cost will be about \$40,000.

GREENVILLE, CAL.—Surveying parties employed by the Great Western Power Company have been engaged the past season on the north fork of the Feather River, between Butte Valley and Belden. Some big developments in the installation of hydroelectric plants are expected to take place next season.

REDDING, CAL.—The Northern California Power Company has taken an option for five years on the Weaverville Electric Company's plant and will extend lines to Weaverville and possibly to Junction City, where connection will be made with lines of the Western States Power Company, that serves Eureka.

BUTTE, MONT.—Development of a 200,000 h.p. project in the Big Horn canyon in Montana is being considered and the proposal to use it for electrification of one of the units of the Northern Pacific Railway is one of the uses to which the power will probably be put. The estimated cost of the project is \$12,000,000.

LOS ANGELES, CAL.—Mayor F. T. Woodman, R. F. Del Valle, president of the public service commission; Martin Betkouski, president of the city council; W. A. Roberts of the council public service committee and John W. Kemp of the public service commission were appointed as a committee by Mayor Woodman, to negotiate with the power companies for the purchase of their distributing systems inside the city.

TACOMA, WASH.—Geo. A. Avery of Roy, has requested of the commissioners a franchise to construct transmission lines over highways near Dupont. A hearing will be had on same at 11 a. m., October 19th. Tentative plans for heating all of the city's department stores and office buildings through a central heating plant backed by local capital and the diversion of about \$25,000 worth of new lighting business annually to the city lighting plant, have been made between the city council and W. H. Snell, Edw. Fogg and J. Walsh, a committee representing the new heating concern.

TELEPHONE AND TELEGRAPH.

ONTARIO, CAL.—The Western Union will soon erect a modern office building in this city.

SPOKANE, WASH.—The inclusion of a proposition to bond the city for the purpose of installing a municipal phone plant in the next municipal election now appears practically certain.

STANWOOD, WASH.—Articles have been filed with the county auditor for the Peoples Telephone Company with headquarters here. Capital is \$10,000. Peter Henning and others are the incorporators.

CHEHALIS, WASH.—The Salzer Valley Telephone Company has petitioned the Lewis county commissioners for a franchise to construct and operate telephone lines south of Centralia over the county roads.

SALEM, ORE.—The Victor Point and Silverton Co-operative Telephone Company has filed articles. It proposes to build and operate a farmers' telephone line between Victor Point and Silverton. W. F. Krantz and others are the incorporators.

ABERDEEN, WASH.—W. C. Mumaw has received notice of the approval by his company of the proposal to construct the Humptulips telephone line. It has not been decided whether it will be constructed this fall or next year. Construction will start from Hoquiam and cost will be \$7500.

LOS ANGELES, CAL.—The Municipal League has appointed a committee to report on the proposed telephone merger. The committee is composed of Lee Chamberlain, R. W. Burnham, H. C. Fryman, C. W. Conant, Tracy C. Becker, F. F. Dodson, M. O. Graves, S. G. Marsbutz and Seward C. Simons.

EUGENE, ORE.—The Northwestern Telephone Company is seeking an entrance into Eugene for a long distance line. This company maintains a service between Portland, Oregon City, Albany and Corvallis. It proposes to erect a central office with central lines to offices and business houses, having a large amount of long-distance business but will not conduct a local telephone business.

SANTA BARBARA, CAL.—William R. Staats & Company have purchased \$100,000 of the issued 5 per cent 30-year bonds of the Santa Barbara Telephone Company, which recently purchased all the properties of the Pacific Telephone and Telegraph Company, the Home Telephone of Santa Bar-

bara and the Home Telephone of Santa Barbara county. The issue is secured by combined properties whose structural value is appraised at \$821,521.

TRANSPORTATION.

RICHMOND, CAL.—The extension of the street car line on San Pablo avenue, from Grand Canyon Park up San Pablo Canyon to the new dam of the Peoples Water Company, is the latest traffic plan in Richmond. The new line will be about six miles in length.

STEILACOOM, WASH.—The council has passed an ordinance granting the Pacific Traction Company the right to construct, maintain and operate single or double track railway on Steilacoom boulevard, between the town limits of Steilacoom and Starling street.

IRRIGATION.

BLTYHE, CAL.—It now looks as if the region of Cibola is to have an irrigation system whereby a portion of the land will be watered.

TALENT, ORE.—C. E. Bade has been engaged by the Talent Irrigation District to construct a system to irrigate 5000 acres of land.

EVERETT, WASH.—J. F. Klein and others have filed on 1000 cu. ft. of water per second on the Boulder River in the southern section of the county and plan development of water power.

SEATTLE, WASH.—The King and Pierce County river improvement fund will have \$150,000 aside from the \$100,000 appropriated by Pierce County. Other river improvements will cost \$30,000.

MODESTO, CAL.—Bids for the \$465,000 bond issue of the Waterford Irrigation District, voted last month, have been opened by the board of directors, and the sale of the bonds taken under advisement.

MONTAGUE, CAL.—The Lucerne Water Company has applied for permission to appropriate 50 cubic feet per second of the waters of Shasta River, tributary to Klamath River, for irrigating 5000 acres. The estimated cost of the project is given as \$50,000.

BOISE, IDAHO.—The Secretary of the Interior authorizes the reclamation service to construct two drains out of the sum of \$350,000 set aside for drainage construction in co-operation with the Pioneer Irrigation District, Boise project, provided the engineers consider such work necessary.

TERRA BELLA, CAL.—Sealed bids for the construction of an irrigation works for the Terra Bella Irrigation District will be received by the board of directors up to November 13th. The work comprises the construction of 16 wells and well pumping plants and 40 miles of pipe line of from 30 to 40 inches in diameter.

EXETER, CAL.—Work for the Lindsay-Strathmore Irrigation District has started in earnest, and men are already busy with the installing of miles of redwood pipes needed to carry the water from the Exeter district to where it is needed to supply the orange groves in the Lindsay and Strathmore districts. The Redwood Manufacturing Company of San Francisco has the contract for supplying all of the redwood stave pipe.

VICTORVILLE, CAL.—Wm. M. Hunt, Jr., on behalf of the proposed Mohave Irrigation District, now in process of formation, has applied for permission to appropriate 300 cu. ft. per second of the waters of Deep Creek and West Fork of the Mojave River, tributary to Mojave River in San Bernardino county. The plan proposes a dam for impounding 100,000 acre feet of water and main canals 30 miles long, for the irrigation of 50,000 acres.

INTERIOR CONDUIT TABLE.

In order to have a basis on which to work for arriving at the proper size of conduit to use in connection with the installation of insulated wires, of various sizes and number, the Electrical Department of the City of Portland, Oregon, and the Underwriters' Equitable Rating Bureau have compiled the following table.

Conduit Table.—Giving Sizes of Conduit Which Will be Required for Various Combinations of Wires.

Size.	Area.	½ in.	¾ in.	1 in.	1¼ in.	1½ in.	2 in.	2½ in.	3 in.	3½ in.	4 in.	5 in.
½ in.....	.196	.392	.638	.981	1.423	1.963	3.337	5.105	7.265	9.817	12.762	19.831
		¾	1	1	1¼	1½	2	2½	3	3½	4	5
¾ in.....	.442	.638	.884	1.227	1.669	2.209	3.583	5.351	7.511	10.063	13.008	20.077
		¾	1	1¼	1½	1½	2	2½	3	3½	4	5
1 in.....	.785	.981	1.227	1.570	2.012	2.552	3.926	5.694	7.854	10.406	13.351	20.420
		1	1¼	1½	1½	1½	2	2½	3	3½	4	5
1¼ in.....	1.227	1.423	1.669	2.012	2.454	2.994	4.368	6.136	8.296	10.848	13.793	20.862
		1¼	1½	1½	2	2	2½	3	3	3½	4	5
1½ in.....	1.767	1.963	2.209	2.552	2.994	3.534	4.908	6.676	8.836	11.388	14.333	21.402
		1½	1½	2	2	2	2½	3	3½	4	4	5
2 in.....	3.141	3.337	3.583	3.926	4.368	4.908	6.282	8.050	10.210	12.762	15.707	22.776
		2	2	2	2½	2½	3	3	3½	4	4½	5
2½ in.....	4.909	5.105	5.351	5.694	6.136	6.676	8.050	9.818	11.978	14.530	17.475	24.544
		2½	2½	2½	2½	3	3	3½	4	4	4½	6
3 in.....	7.069	7.265	7.511	7.854	8.296	8.836	10.210	11.978	14.138	16.690	19.635	26.704
		3	3	3	3	3½	3½	4	4	4½	5	6
3½ in.....	9.621	9.817	10.063	10.406	10.848	11.388	12.762	14.530	16.690	19.242	22.187	29.256
		3½	3½	3½	3½	4	4	4½	4½	5	5	6
4 in.....	12.566	12.762	13.008	13.351	13.793	14.333	15.707	17.475	19.635	22.187	25.132	.....
		4	4	4	4	4½	4½	4½	5	5	6	..
5 in.....	19.635	19.831	20.077	20.420	20.862	21.402	22.776	24.544	26.704	29.256	.....	.....
		5	5	5	5	5	5	6	6	6	..	..

Rule 28 (i) of the N. E. C. is as follows:

Size of Conduits for the Installation of Wires and Cables.

Size B. & S.	Number of Conductors in System.			
	One conductor in a conduit. Size conduit, in. Electrical trade size.	Two conductors in a conduit. Size conduit, in. Electrical trade size.	Three conductors in a conduit. Size conduit, in. Electrical trade size.	Four conductors in a conduit. Size conduit, in. Electrical trade size.
14	½	½	½	¾
12	½	¾	¾	¾
10	½	¾	¾	1
8	½	1	1	1
6	½	1	1¼	1¼
5	¾	1¼	1¼	1¼
4	¾	1¼	1¼	1½
3	¾	1¼	1¼	1½
2	¾	1¼	1½	1½
1	¾	1½	1½	2
00	1	1½	2	2
00	1	2	2	2½
000	1	2	2	2½
0000	1¼	2	2½	2½

CM.

200000	1¼	2	2½	2½
250000	1¼	2½	2½	3
300000	1¼	2½	2½	3
400000	1¼	3	3	3½
500000	1½	3	3	3½
600000	1½	3	3½	...
700000	2	3½	3½	...
800000	2	3½	4	...
900000	2	3½	4	...
1000000	2	4	4	...
1250000	2½	4½	4½	...
1500000	2½	4½	5	...
1750000	3	5	5	...
2000000	3	5	6	...

Twin Conductor.

14	½	¾	1	1
12	½	¾	1	1¼
10	¾	1	1¼	1¼

Single Conductor Combination.

Note.—Where special permission has been given in accordance with No. 26, p. the following table to apply.

No. of Wires.	Size Conduit, in. Electrical Trade Size.
3 No. 14 R.C. solid.....	½
5 No. 14 R.C. solid.....	¾
10 No. 14 R.C. solid.....	1
18 No. 14 R.C. solid.....	1¼
24 No. 14 R.C. solid.....	1½
40 No. 14 R.C. solid.....	2
74 No. 14 R.C. solid.....	2½
90 No. 14 R.C. solid.....	3

Three Conductor Convertible System.

—Size of Conductors—		Size Conduit, in. Electrical Trade Size.	
Two Conductor. Size B. & S.	One Conductor. Size B. & S.		
14	10	¾	
12	8	¾	
10	6	1	
8	4	1	
6	2	1¼	
5	1	1¼	
4	0	1½	
3	00	1½	
2	000	1½	
1	0000	2	
0	250000	2	
00	350000	2½	
000	400000	2½	
0000	550000	3	
250000	600000	3	
300000	800000	3	
400000	1000000	3½	
500000	1250000	4	
600000	1500000	4	
700000	1750000	4½	
800000	2000000	4½	

TRADE NOTES.

The California-Oregon Power Company is moving to the ground floor of the Annex of the Merchants National Bank building, San Francisco, where it will have much larger offices than at its former location.

The National Lamp Works, for the second successive year, is conducting a show window trimming contest among its distributors all over the country. Sixty prizes are offered ranging from a Ford touring car down to five dollars in cash. To every entrant in the contest a 32-page album entitled "How Sixty Window Experts Display National Mazdas" is being sent. This publication contains pictures of sixty of the best rims produced in last year's contest with reading matter emphasizing the features that lend selling value to each display.

Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEXNumber
28

Remote Control Switches.

	List.	Sell.
30 Amp., D. P., not fused.....	8.00	8.00
60 Amp., D. P., not fused.....	12.00	12.00
100 Amp., D. P., not fused.....	24.40	24.40
200 Amp., D. P., not fused.....	32.00	32.00
400 Amp., D. P., not fused.....	74.80	74.80
600 Amp., D. P., not fused.....	98.60	98.60
30 Amp., T. P., not fused.....	10.75	10.75
60 Amp., T. P., not fused.....	15.00	15.00
100 Amp., T. P., not fused.....	31.40	31.40
200 Amp., T. P., not fused.....	41.70	41.70
400 Amp., T. P., not fused.....	95.30	95.30
600 Amp., T. P., not fused.....	118.40	118.40
1000 Amp., T. P., not fused.....	140.00	140.00
1200 Amp., T. P., not fused.....	160.00	160.00
2000 Amp., T. P., not fused.....	265.00	265.00
4000 Amp., T. P., not fused.....	494.00	494.00

Wood Screws, Per Gross.

1/2 in. No. 5, F. H.....	.78	.80
3/4 in. No. 7, F. H.....	.90	.90
1 in. No. 8, F. H.....	.95	.95
1 1/4 in. No. 8, F. H.....	1.05	1.05
1 in. No. 9, F. H.....	1.10	1.10
1 1/4 in. No. 9, F. H.....	1.20	1.20
1 1/2 in. No. 10, R. H. Blue.....	1.40	1.40
2 in. No. 10, R. H. Blue.....	1.75	1.75
1 1/2 in. No. 14, R. H. Blue.....	2.00	2.00
2 in. No. 14, R. H. Blue.....	2.45	2.45
2 1/2 in. No. 14, R. H. Blue.....	2.90	2.90
2 1/2 in. No. 10, F. H. W.....	2.40	2.40
3 in. No. 12, F. H. W.....	3.30	3.30

Machine Screws, Per Gross.

1/2 in. 6/32, Round or Flat Head.....	.39	.40
1 in. 6/32, Round or Flat Head.....	.55	.55
1 1/2 in. 6/32, Round or Flat Head.....	.75	.75
2 in. 6/32, Round or Flat Head.....	1.15	1.15
2 1/2 in. 6/32, Round or Flat Head.....	1.25	1.25
1/2 in. 10/24, Round or Flat Head.....	.70	.70
1 in. 10/24, Round or Flat Head.....	.90	.90
1 1/2 in. 10/24, Round or Flat Head.....	1.30	1.30

Nuts, Per 100.

6/32 Iron.....	1.08	1.08
8/32 Iron.....	1.22	1.22
10/24 Iron.....	1.20	1.30

Window Reflector.

Helmet.....	5.00	5.00
Scoop.....	3.50	3.50
Poke Bonnet.....	6.50	6.50

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

Journal of Electricity, Power and Gas
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Knife Switches—250 Volts.

D. P. Entrance Switch.....	List.	Sell.
T. P. Entrance Switch.....	1.00	1.00
	1.40	1.40

Porcelain Sub-Base.

5 Amp., Surface, Concealed and Moulding..	.05	.05
10 Amp., Surface, Concealed and Moulding..	.06	.10
20-30 Amp., Surface, Concealed and Moulding	.15	.20

Low Voltage Release Switch, for A. C. or D. C.
Motors—110 or 220 Volts A. C. or D. C.

60 Amp., 3-P.....	20.00	20.00
100 Amp., 3-P.....	30.00	30.00
60 Amp., 2-P.....	16.00	16.00
100 Amp., 2-P.....	24.00	24.00

400 Volts, A. C.

3-P.....	34.00	26.00
2-P.....	22.00	28.00

Add 10 per cent to list price for fusible switch. Prices are for front connections, plain finish. Steel box with hinged door for enclosing switch, add \$1.50 net. D. T. Switch for Star Delta connection, add \$2.50 net.

Time Limit Overload Switches for A. C.

Motors—220 or 440 Volts A. C. or
230 D. C. Motors.

Up to 60 Amp., 3-P. (2 coils).....	27.00	27.00
Up to 100 Amp., 3-P. (2 coils).....	38.00	38.00
Up to 60 Amp., 2-P. (1 coil).....	20.00	20.00
Up to 100 Amp., 2-P. (1 coil).....	30.00	30.00

Steel box with hinged door for enclosing switch, add \$1.50 net. O. T. switch for Star Delta connections, add \$2.50 net.

Automobile Switches.

Style A. S. P.....	.50	.50
Style B. S. P.....	.65	.65
Style B. 3-Point.....	.75	.75
Style B., 3-Point, Removable Key.....	.85	.85
Style B., Removable Key.....	.75	.75
Style B., Sunken Plate.....	.75	.75
Style B., Sunken Plate, Removable Key.....	.85	.85

Switches—Motor Starter.

30 Amp., D. P. D. T.....	4.12	4.50
60 Amp., D. P. D. T.....	5.50	5.50
30 Amp., T. P. D. T.....	5.50	5.50
60 Amp., T. P. D. T.....	7.30	7.30
30 Amp., F. P. D. T.....	6.68	6.75
60 Amp., F. P. D. T.....	8.40	8.40

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BY ROBERT SIBLEY.

COST OF PUMPING FOR IRRIGATION.

BY O. L. WALLER.

ELECTRIC BAKING AT SALT LAKE CITY.

BY G. W. COLE.

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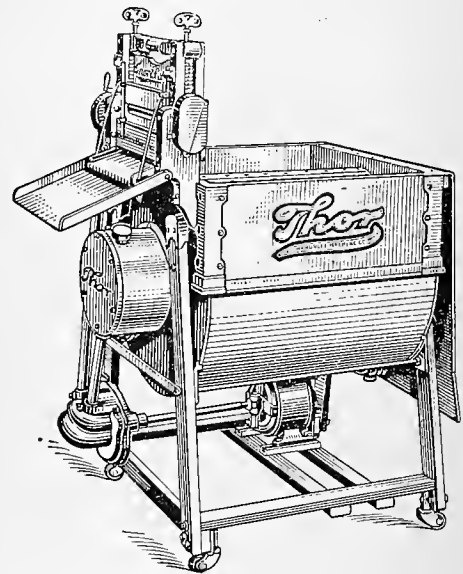
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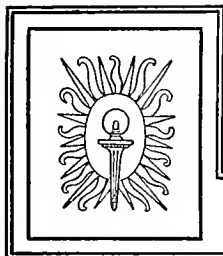
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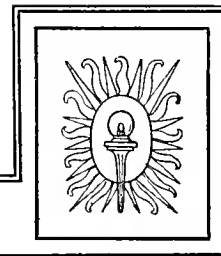
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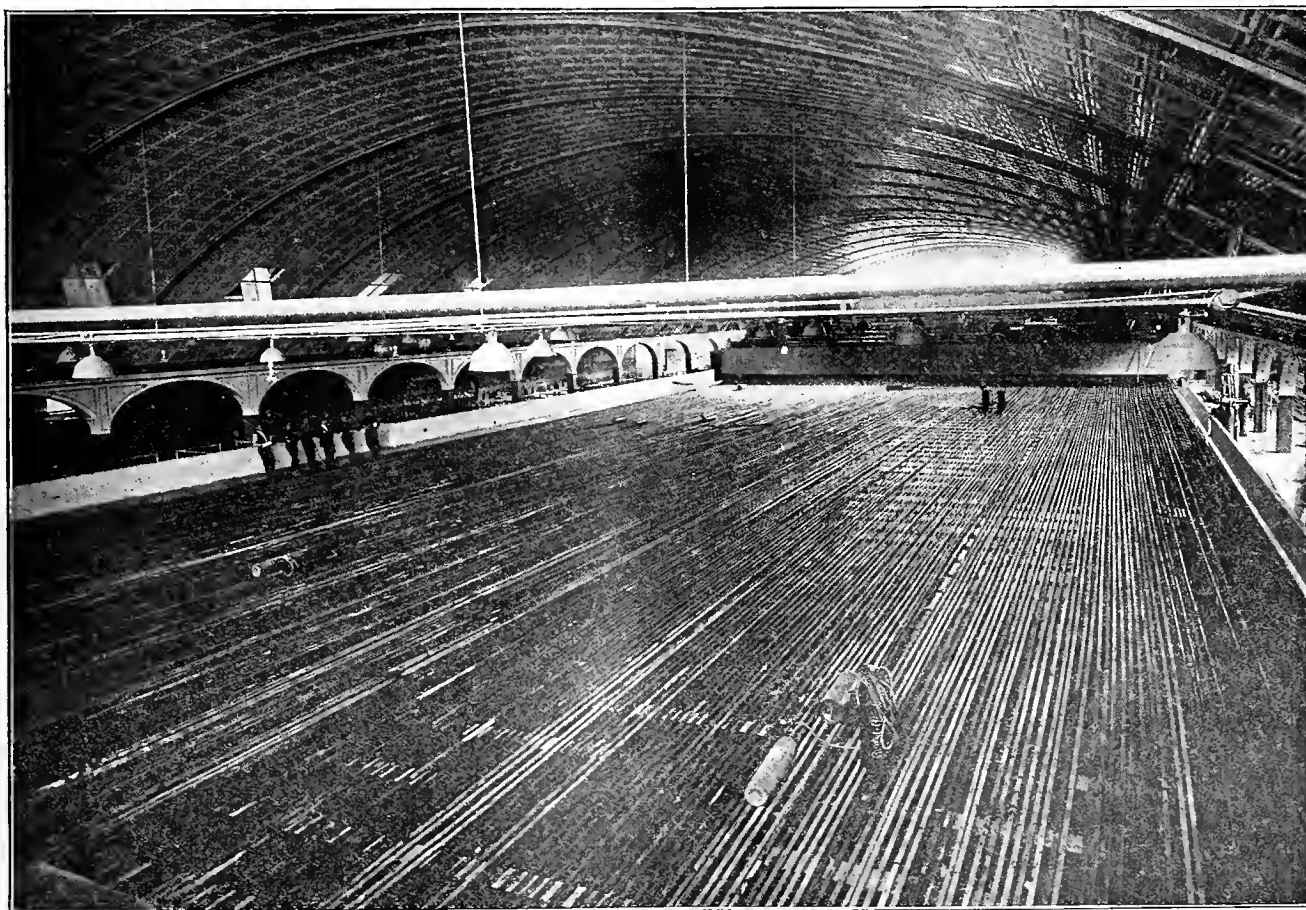
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AN ICE PALACE AND ITS TECHNICAL FEATURES

BY ROBERT SIBLEY.

Artificial ice-skating on the Pacific Coast is not only creating a new health-giving, invigorating, pastime for its people, hitherto unacquainted with the joys of winter sports, due to the temperate climate in which they live, but the net result to the electrical in-

On October 10, 1916, the new Winter Garden, a huge ice rink with exterior building dimensions of 275 by 144 ft. was thrown open to the public. This building is situated at the corner of Pierce & Sutter streets. On the occasion of its dedication the ice palace was



Ten and One-Half Miles of Steel Piping Welded Together for the Formation of an Artificial Ice Pond.

dustry is an ever increasing profitable power load of almost ideal demands.

The possibility of artificial ice-skating in the West was first heralded and put to a practical test in Portland, Ore., some two years ago. The new pastime proved so fascinating that it rapidly spread to other coast cities. In San Francisco the sport has been especially cordially received by its frolicing, play-loving people.

crowded to its limit and it is estimated that in addition some fifteen hundred people were refused admission.

The space devoted to ice skating is of the regulation hockey proportions and measures 210 by 90 ft.

The building has box seats, reserved seats and general admission seats that will accommodate two thousand spectators. Surrounding the rink are also to be found dressing rooms, hot and cold showers, a dance floor 100 by 90 ft., and confectionery stand.

skating rink. Upon the former skating rink floor was laid eight inches of heat insulating material such as sawdust and water-proof roofing. Upon this was laid a sprinkling of sand, and upon the sand 55,000 ft. of two-inch steel piping. This piping, though remarkable for length, is also remarkable for the fact that it has but 134 joints. These were left to serve as expansion joints. The remaining 4867 connections were done away with by welding the ends together by the oxy-acetylene process.



The Electrically Drawn Ice Planer Preparing the Ice Surface for Skating.

The Capacity of the Refrigeration System.

In the various parts that make up the refrigeration details for this ice rink, practically all units are installed in duplicate to insure continuity of service. The ice plant itself consists of two 50-ton units, each operated by electric motors of 100 h.p. capacity. 2500 gallons of brine, composed of a 75 per cent solution, are used in the circulating system for creating the artificial ice pond. The average quantity of brine circulated per minute is about fifteen gallons. This is, however, carefully regulated, so that the temperature of the ice in the rink is kept as nearly 32 deg. F. as possible since this temperature of freezing water has proven best for maintaining a smooth surface of the ice.

It is found necessary to trim the ice three times daily in order to maintain the surface absolutely smooth. This is efficiently accomplished by means of an electrically drawn ice planer as shown in the diagram.

The ice pond is well lighted by means of some 1200 lamps of 150 c.p. capacity which are evenly distributed over the skating area. Throughout the building there are in all over 2000 lighting outlets.

The compressor and refrigerating machinery were installed by the Cyclops Iron Works of San Francisco; the piping was furnished, welded and laid by the Pacific Pipe Company of San Francisco; the electric truck for drawing the ice planer by the San Francisco branch of the Edison Storage Battery Company; and Mr. J. T. Ludlow, a consulting engineer of San Francisco, acted as architect and engineer for the complete installation.

COST OF PUMPING FOR IRRIGATION.

BY O. L. WALLER.

(This interesting paper sets forth in clear, concise language the yearly operating costs of irrigation pumping, particularly as relates to conditions in the Inland Empire of the Northwest. The paper is taken from Popular Bulletin No. 104 as published by the Washington Agricultural Experiment Station. The author is an irrigation engineer of Pullman, Wash.—The Editor.)

The office of the irrigation engineer receives hundreds of letters each year asking for information about pumping plants and the writers of these letters all want to know if pumping under their particular conditions can be done profitably. It has seemed to the writer that many of the inquiries could be answered by a general bulletin. Consequently the purpose of this bulletin is to provide an answer to as many of these letters as possible by selecting a problem and solving it. In making up data we have kept in mind the results actually secured by the farmers. In many instances the actual working results fall far short of those claimed by the manufacturers of pumps and engines. Pumping plants installed on farms are usually not operated by expert machinists and consequently cannot be expected to give results equal to manufacturers' ratings. Farmers, buying pumps and engines should keep this in mind.

From the many problems received we may select the following: A farmer wants to irrigate 80 acres of sandy loam soil with a total pumping lift of 65 feet. What will be the probable cost per acre per year; first cost of plant, operating charges, depreciation, taxes, interest on first cost, etc., being considered?

The answer to all of these inquiries will depend largely upon the amount of water used. The amount of water needed to successfully grow crops will depend on the kind of crop raised, the kind of soil upon which the water is used, the temperature and wind conditions, the distributing system, the character of the cultivation, etc.

When the farmer, knowing his local conditions, has made up his mind as to about how much water will be needed per acre, and the number of acres to be irrigated, the product of the number of acre feet of water needed per acre by the number of acres to be irrigated, will give the total amount of water to be pumped during the irrigation season, of about four months or 120 days. Practice has shown that about one-third of this amount will be needed during the hottest month. Taking one-third of the total season's requirement, as the amount to be pumped during the hottest month, dividing this amount by 30, we find the number of acre feet to be pumped each day. The latter figure divided by two will reduce the amount required to cubic feet per second and finally if the number of cubic feet per second is multiplied by 450 the result will be the number of gallons per minute to be pumped, pump operating 24 hours per day. Knowing the number of gallons per minute to be pumped a pump catalogue will give the size of the pump. Having thus determined the size of the pump required we will next find the amount of power needed to do the pumping.

In the above we found the number of cubic feet per second required. Multiplying this by 0.1135 and

by the lift in feet (including measured lift, friction head lost in the delivery pipe, suction lift, etc.) will give the theoretical horsepower. The actual power required to do the pumping for small plants ranging from 10 to 15 horsepower will be about three times this theoretical amount; for smaller plants more than three times this amount will be needed, and for larger plants less than three times will be needed. This is based on the joint efficiency of motor and pump or engine and pump, as the case may be, and when both are working under average farm conditions.

Assuming that you are expecting to buy either a gasoline, distillate or oil engine then you will want to know how much gasoline, distillate or oil will be needed to do your pumping. If this factor were known you could find out from the oil company the cost of the season's supply.

A careful study of the literature giving cost data on pumping plants reveals a wide variation in power costs. All available data were examined and platted for the purpose of determining how much gas, distillate or oil was used under actual farm conditions to pump one acre foot of water one foot high and from these data the attached table No. 1 was made up. It

Table I.

Table showing gallons of gasoline, distillate, or crude oil used, under average farm practice, to lift one acre foot of water one foot high.

Horsepower.	Engine belted to a centrifugal pump.		Engine belted to a deep well pump.	
	Gallons.	Efficiency of plant.	Gallons.	Efficiency of plant.
2	1.14	.15	1.8	.10
3	.94	.18	1.2	.15
4	.83	.20	.91	.19
5	.76	.23	.79	.22
6	.70	.26	.70	.25
7	.66	.27	.63	.27
8	.62	.28	.58	.30
10	.58	.29	.53	.33
12	.57	.30	.49	.35
15	.55	.31	.45	.38
20	.51	.34	.40	.43
30	.45	.38	.33	.52
25	.48	.36	.36	.48
35	.42	.41	.29	.60

will be observed that small pumping plants used much more fuel in proportion to the work done than large ones. In other words it costs more for fuel to lift an acre foot of water one foot high with a small plant than with a large one.

Some of the cases studied showed that the pumping plant was too big for the job and considerable fuel was wasted in turning over a big engine and pump for a small amount of water, or it might have been so big that it was only operated for a few hours per week. It is not economical to run an engine at light load. Many of the engines used for irrigation pumping are too large for the service they are required to render. In such cases the interest on the investment is large, the depreciation charges and taxes are much heavier than they would be on a properly sized outfit. Motto: Buy as big as you need, but no bigger.

The plant should be designed for the maximum service during the hottest month and it should not be larger than is necessary for this maximum service. Whenever it is in operation it should be run up to its rated speed or in other words, it should be required to deliver water at its maximum capacity.

Several hundred tests have been run on small pumping plants in the United States (most of which were in use for irrigation) to determine their per-

formance. These data have been published and are available to any one wishing to make a study of them. A class in irrigation engineering in the State College of Washington spent some time plotting the data contained in these published reports and in deducing the attached table of gas and oil consumption required to lift one acre foot of water one foot high. This table shows actual performance of pumping plants in operation on farms. These averages include good outfits and poor outfits. If you put in a poor and improperly designed plant you should not expect to get as good results as the table shows. If you put in a good plant, one designed for your particular service, you may expect better results than those here shown.

If you expect to use a centrifugal or turbine pump you should know the exact pressure gauge head under which it is to be operated. And in no case buy a stock pump unless said stock pump is designed for your particular lift. Buy a well made pump, one that has a record for high efficiency, and that has stood up under service, that has required a minimum of repairs, and that continues to deliver water up to its rated capacity, and then you must give it good care if you expect it to be economical. It is not the purpose of this bulletin to discuss the mechanics of the above statements, but it is enough to say to the farmer that unless the pump is well built and designed for his particular pressure gauge lift, it will waste power and consequently waste his money.

Problem—To determine the amount of gas or oil required to irrigate 80 acres under a 65-foot lift, water to be pumped with a centrifugal pump, belted to a gasoline or oil engine:

From the character of the soil, climatic conditions, etc., we must determine how many acre feet of water will be needed for each acre of land. An acre foot is the amount of water required to cover one acre one foot or 12 inches deep. The whole amount needed for the season will be arrived at by multiplying 80 acres by the number of acre feet per acre required. In this case we will assume that the land will require three acre feet per acre or the equivalent of 36 inches of rainfall during the growing season. Then 80 multiplied by 3 equals 240 acre feet of water needed for the growing season. If this is multiplied by 65, the number of feet that it must be lifted, the result will be 15,600 acre feet feet. An acre foot foot may be defined as one acre foot of water lifted one foot high. Then 240 acre feet of water lifted 65 feet onto the land to be irrigated will give 15,600 acre feet feet. This multiplied by .54 gallons, the amount of gasoline or oil which farm practice has shown will be required to lift one acre foot of water one foot high, will give 7,800 gallons for the season's run. The one-half gallon of gasoline used in this last multiplication was taken from the table and is the amount of gasoline or oil that a 25-horsepower engine would consume in lifting one acre foot of water one foot high. Having thus determined the amount of gasoline or oil required for the season's run, and knowing the market prices it is easy to arrive at the cost of the fuel used.

To this must be added the yearly depreciation on the plant, interest on the cost of same, time of man required to run the pump, cost of oils, waste and repairs. When all these items are determined and

added, the total cost per acre for water can be arrived at by dividing this grand total by the number of acres irrigated.

The prices of gasoline, kerosene, distillate and heavy oils vary so much in different localities that it seems best to estimate the amount used and leave it to the prospective user, knowing the market price for such product, to make his own estimate of cost.

In selecting a pump and motor of the right size, for the problem stated, it may be assumed that one-third of all the water to be used during the season should be used during the hottest month or that 80 acre feet must be pumped in 30 days or that the pump must handle 1 1-3 second feet. This would require a pump lifting 600 gallons per minute, and operating 24 hours per day. A well constructed No. 5 pump running at proper speed will deliver that amount of water. In passing it is safe to say that centrifugal pumps are generally over-rated and that they usually do not deliver the amount of water they are supposed to deliver. In installing a pump this fact should be kept in mind and the manufacturer should be required to guarantee the delivery of the pump and the over all efficiency of the plant, and the plant should not be accepted and paid for until a test has been run to see that the guarantee has been fully complied with. A plant that does not give a high efficiency and maintain it, is wasting your money. The theoretical horsepower required would be secured by multiplying 1 1-3 cubic feet per second by 65, the lift in feet, and this product by the constant 0.1135 which gives 9.88. A 25-horsepower engine will therefore be selected, which is rather smaller than Table I calls for.

If you are about to buy a pumping plant for irrigation purposes it will pay you to visit several plants in operation—some using distillate or oil and some using electricity. You should study pumps as well as engines and motors. You want an outfit that will deliver its rated amount of water continuously, one that is simple and that is easily kept in order and one upon which the operating expenses do not continually grow larger.

Tests have repeatedly shown that each centrifugal pump has its highest efficiency at some particular speed and that it costs more to operate them at a higher or a lower speed. When a pump has been tested and the speed of its highest efficiency determined it should then always be run at that particular speed.

The belt should be wide enough and long enough to do the work, and should be kept in good repair and tight enough so that it will not slip. The foundation for pump and motor should be large enough and strong enough to eliminate vibration.

The efficiencies shown in the table for gas or oil engines, belted to centrifugal pumps, are based on field practice. They are not based on the thermal efficiency of the gasoline, distillate or oil, but rather upon the manufacturer's estimate of one pint of oil or distillate per horsepower hour. In making up the efficiencies the actual amount of distillate or oil used to pump one acre foot of water one foot high was divided by the theoretical amount usually given as

sufficient to do that amount of work. This column of efficiencies is only given to help the purchaser in selecting an engine of proper size and for that purpose it is sufficiently accurate. The efficiencies shown in this table are somewhat higher than those given by some of the investigators, but it is thought that under reasonable conditions they could be attained. Engines and pumps now sold are generally better designed and more efficient than they have been before. If proper sizes are selected (the pump designed for the particular head against which it is to operate), good, solid foundations put under the machinery and all kept in reasonably good working order, these efficiencies should be easily secured.

From the annual report of the office of Experiment Stations of 1908, I quote the following:

"Gasoline engines included with both centrifugal and deep well pumps were delivering about one-fourth their rated capacity, while the electric motors were delivering 31 per cent with centrifugal pumps and 47 per cent with deep well pumps. In other words, in ordinary field practice, rated capacities of gasoline engines are about four times the useful work done, computed from the weight of the water lifted and the measured lift; and the rated capacities of the electric motors used for operating pumps are about three times the work done, computed the same way."

On account of the fluctuations in the materials market, a list of prices on engines, motors and pumps would be out of date before it was published. However, from prices quoted by engine manufacturers, a 25-horsepower crude oil engine of substantial type, installed, would cost about.....\$1050.00

A pump, designed for high efficiency and low upkeep, installed, may be estimated at... 650.00
Belt 25.00

Cost of plant.....\$1725.00

Operating Costs per Year.

7800 gal. crude oil, 28 test at 5c.....	\$390.00
Cylinder oil	35.00
Interest, depreciation and taxes, at 20 per cent.....	345.00
Attendance, 2 hrs. per day, 120 days, at 40c per hr.....	96.00
Repairs each year, estimated at 2½ per cent.....	43.00
Hauling fuel oil 5 miles, estimated.....	45.00

Total operating costs.....\$959.00
Cost per acre per season.....\$ 11.90

If distillate, at about 13 cents per gallon, were used the cost would be materially increased. As estimates of cost are usually made there is a disposition to consider only the cost of the gasoline, distillate or oil used and to omit all the other items which are quite as much a part of the real cost of pumping as is the fuel charge.

The item of attendance must not be omitted. A good outfit will require less attention than a poor one, but any plant that is kept in good working order and that works economically will require considerable attention.

A gentleman who has had considerable experience with gas engine pumping plants, says:

"The man who thinks he can install a gas outfit and that he can go away and leave it and that it will always work all right until he comes back in a couple of hours, has another think coming as it may and it may not do it."

The same gentleman recommends one of the very

best made pumps and further says that a "centrifugal pump made by the ordinary foundry or machine shop is only a guess at the best and is not worth the iron that is in it."

The pump should be set close to the water, using only a short suction lift, and the discharge pipe should be large enough to keep the friction losses low. A reasonably large discharge pipe is more economical than pumping against a high friction head.

Through the courtesy of the Pacific Power & Light Company the writer has had access to all the notes and data connected with tests run by that company on about 150 electrically driven pumping plants in Washington in the year 1912. These data in conjunction with a large number taken by the U. S. Department of Agriculture and by some of the western experiment stations were used in making up Table II. The plants were generally made up of centrifugal pumps directly connected with electric motors. The data concerning some of them, having very bad pumps, which were later discarded, were not included in making up Table No. II.

Table II.

Table showing kilowatt hours of electric current used under farm conditions to pump one acre foot of water one foot high.

Induction motor directly connected to a centrifugal or turbine pump.

Horsepower.	Kilowatt hours.	Per cent of Efficiency.
2.5	3.25	.31
5	2.85	.35
7.5	2.50	.40
10	2.35	.42
15	2.20	.45
20	2.05	.49
25	1.90	.52
30	1.80	.55
35	1.70	.59
40	1.65	.60
50	1.60	.62

This table shows the number of kilowatt hours required to pump one acre foot of water one foot high and the third column shows the mean efficiencies. The efficiencies are higher than those secured in gasoline engines and centrifugal pumps.

Le Conte and Tait state that, as a rule, the plant efficiency for the electric pump is definitely higher than for a corresponding plant operated by gasoline.

Elwood Mead says: "The conditions are so varied in different localities that no fair decision can be reached as to which of these forms of power is preferable, but the most general statement, which must be taken with many qualifications, is as follows: When electric power is obtainable, it is best. It is quite certain that of all forms of power available for pumping, the electric motor driven plant will require least attention.

Smith, of the Arizona Station, says: "Where electric power is available, pump and motor should be directly connected on the same bed plate. Such a plant requires the very minimum of attention."

A 20 horsepower electric motor directly connected to a first class turbine pump, installed on a good concrete foundation, all wired and housed and ready to operate, will do the work called for by this problem, and will cost about \$1000, and will require approximately 32,000 kilowatt hours for the season.

These estimates are based on three acre feet per acre. Some porous, sandy lands may require more than that and some of the better soils may use less. This particular number was selected in order to have a basis upon which to make up an estimate.

If you expect to pump water for irrigation you should settle upon the amount of water needed per acre, the size of the plant required, the quality of machinery desired and then through the machinery houses make up an estimate of the cost of the plant to be installed and all ready to run. When this is done an estimate of the cost of a season's operation should be made about as estimated in this bulletin. With this data before you, if a margin of profit warrants the venture, buy the outfit and give it a first class installation. On the other hand, if your estimate shows a probable loss or you think the crops to be raised can not be sold for enough to pay for pumping the water, for your time, and a reasonable profit on your investment, then you better let it alone.

The pumping plant when installed should be tested and adjusted to operate at its highest efficiency. The amount of gasoline, distillate, crude oil or electric current used and the amount of water actually delivered should be determined and the total pressure gauge head measured. With this data the farmer will know what it is costing to irrigate his farm. Many a failure has resulted from the installation of a poor outfit, and a neglect to figure in all the items of cost.

Irrigation practice in Growing Small Fruits in California, by Wells A. Hutchins, is the title of Circular 154 recently issued by the California Agricultural Experiment Station. Such fruits require irrigation at frequent intervals during at least part of the season, a condition which is particularly satisfied by pumping plants, as stated in the bulletin. "The water supply for berry irrigation must be a dependable one throughout the dry season and particularly while fruit is being produced. This applies in greater measure to strawberries than to other small fruits because bushberry plants are the more drought resistant. Only small quantities of water are needed for strawberries at anyone time, but it is needed often, and the lack of water for a protracted period during the summer may prove fatal to the plants or at least impair their crop producing powers for another season. Hence the commercial strawberry grower whose field is located under a canal system with erratic water supply often needs to supplement such supply with a pumping plant. As a matter of fact pumping plants furnish most of the water used in the large berry centers of California. They are usually small plants, for the acreages and heads of water used are small." The preparation of the land for irrigation, methods of distribution of the water, planting arrangements and the application of water to strawberries and bush berries are described for the sections of the state where these products are of importance.

Operating Costs per Year.

Based on the Pacific Power & Light Company's rates	
the cost of this current will be approximately.....	\$526.00
Interest on investment at 8 per cent.....	80.00
Depreciation at 8 per cent.....	80.00
Taxes, 2 per cent.....	20.00
Cylinder, oil, fuses, etc.....	20.00
Attendance, 1 hr. per day for 120 days, at 40c per hr.....	48.00
Total cost of operating.....	\$774.00
Cost per acre irrigated.....	\$ 9.70

ELECTRIC BAKING AT SALT LAKE CITY.

BY G. W. COLE.

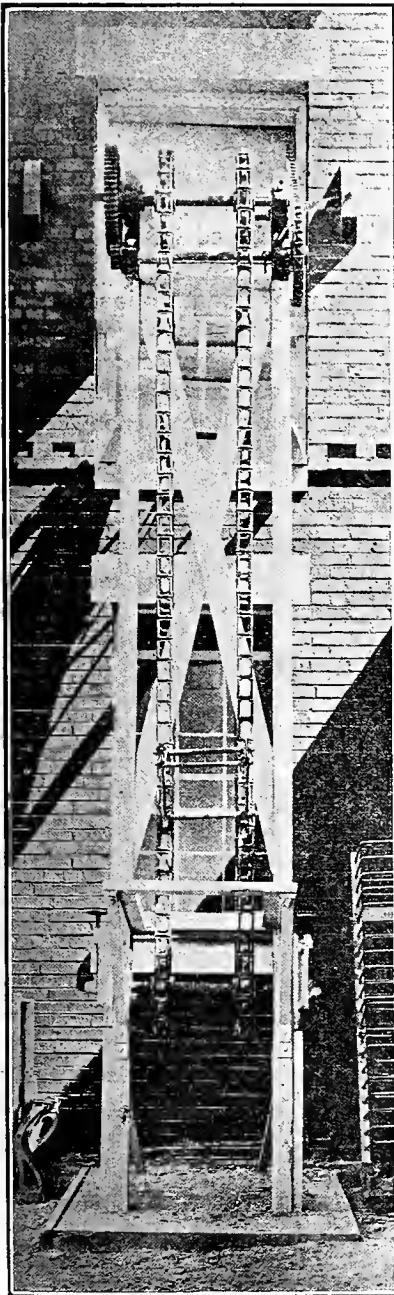
(Detailed description is here given of a bakery where 18,000 loaves of bread are daily made, baked and handled by electricity. Current is supplied by the Utah Power & Light Company, from whose Bulletin this story is reprinted.—The Editor.)

Probably the most complete electrically equipped bakery in the world has just been installed at Salt Lake City by the Vienna Baking Company. From the time the flour is unloaded until the wrapped loaf is in the cooling room, electricity performs the major part of each operation.

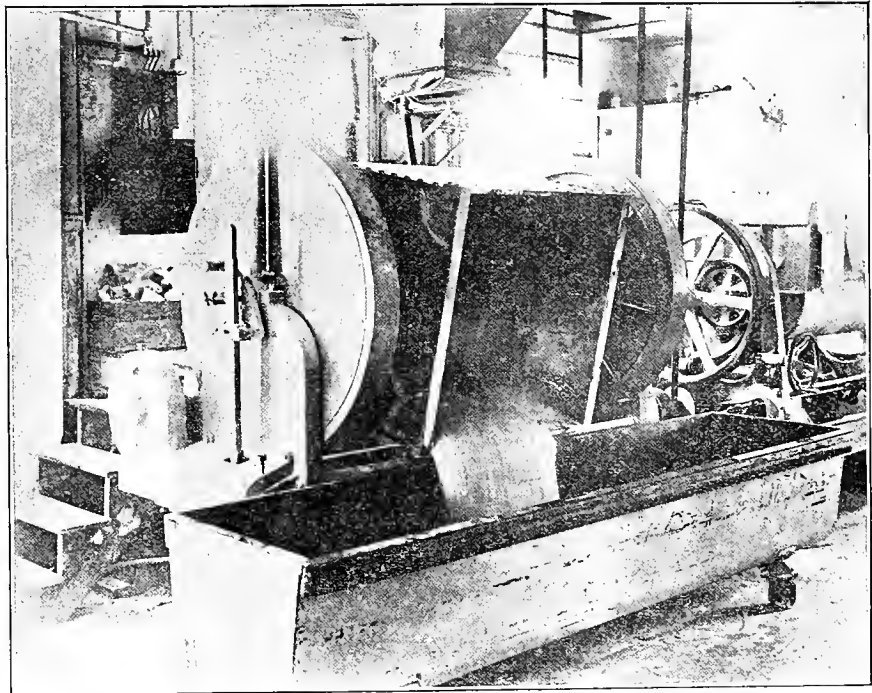
When the dray bringing the flour from the mill backs up to unload, an electrically driven flour elevator

lifts each sack to the second floor, where it is stored in a large storeroom with a capacity of approximately five carloads of flour.

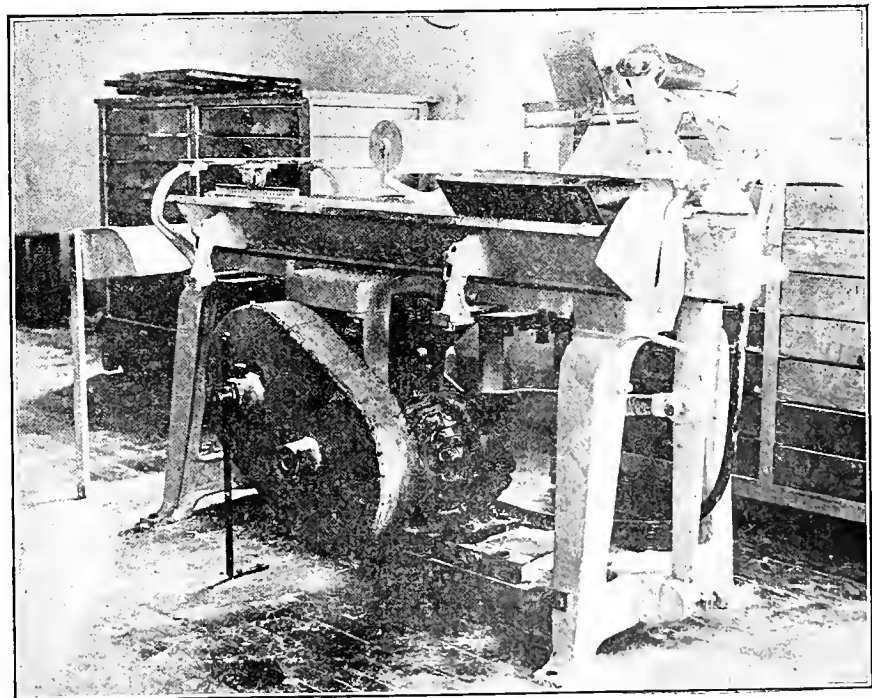
The first operation in the bread making process is to pass all flour through a sifter into the storage bins. From this point it passes into the high speed mixer, which is driven by a 20 h.p. General Electric motor. The use of a high-speed mixer has several advantages over the old style mixer. More air is whipped into the dough, giving it a greater rising power. More water can be added to the mixture, giving an equal consistency to the finished dough. Less yeast is necessary to give a full spring; on account of more air being whipped into the dough, a whiter bread is ob-



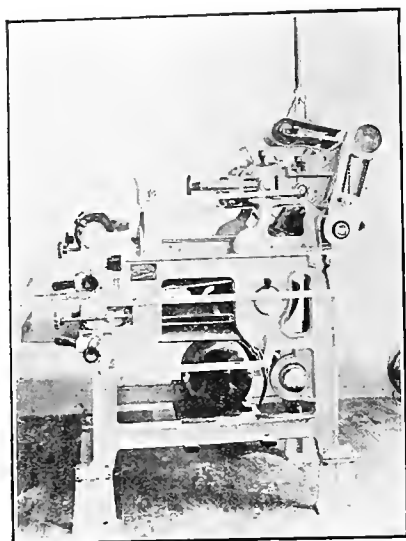
Automatic Flour Elevator.



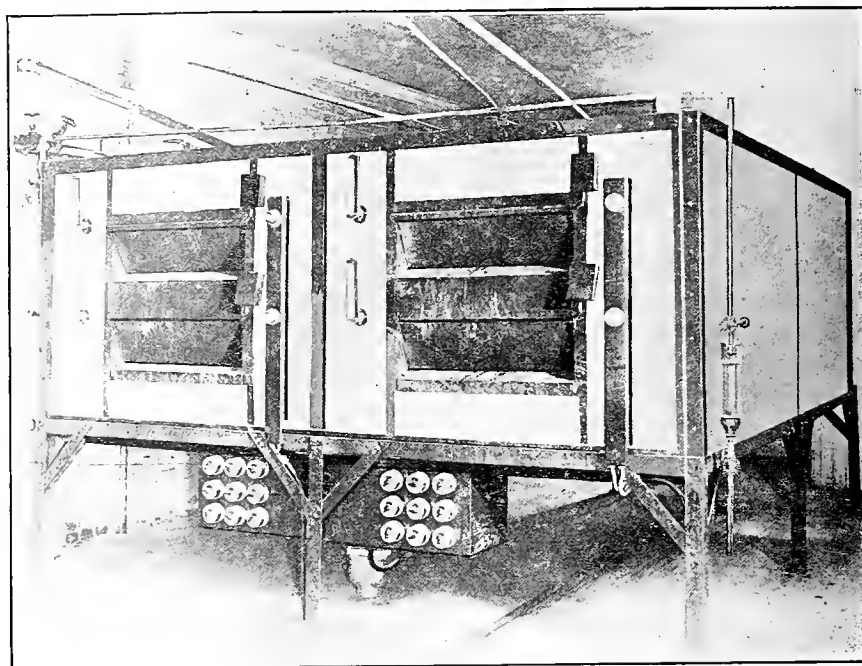
High-speed Dough Mixers and Dough Trough.



Dough Rounder.



Loaf Moulder.



Hughes Electric Oven at Vienna Bakery.

tained after baking. This mixer has a capacity of about 800 loaves per mix, and can turn out about 1000 loaves per hour. As the dough is turned from the mixer, it is put in dough troughs, where it is allowed to remain five hours, while the yeast does its work, and fills the trough full of a soft billowy-like smooth textured dough. After about four hours in the trough, the dough is "worked down" and allowed to "raise" again for about an hour, when it is ready for the scaling machine. Great pieces of dough, weighing forty or fifty pounds, are dropped into the scaler, where the loaves are weighed and cut off automatically, by a cubical contents process. There will not be a variation in the weights of the pieces of dough, of more than one quarter of an ounce, during the entire run. This scaler can be adjusted for any weight of loaf desired. The dough, after dropping onto the endless belt of the scaler, is carried to the rounder, where it is rolled between two aluminum bars, which have practically the same motion as if the dough were kneaded by hand, and finally drops into a receiver, as a small round ball of dough. Both of these machines are motor driven, and automatic in their operation.

As the balls of dough leave the rounder, they are put in proof boxes, where they remain for forty to fifty minutes, to allow the yeast to spring and give life to the dough.

After the dough has begun to lighten somewhat, it is put through a motor driven moulder, which is nothing more than a stationary belt, with a revolving belt passing just above it. As the dough passes along between these belts, it is rolled into a cylindrical shape about two inches in diameter, by eight inches long, two of these pieces being put in each pan, to make a ten-cent loaf of bread. As the pans are filled, they are put in pan racks, three ten-cent loaves to a pan and seventy pans to a rack, after which the rack is put in the steam proofing box, where the dough is allowed to raise until the proper spring has been reached, when

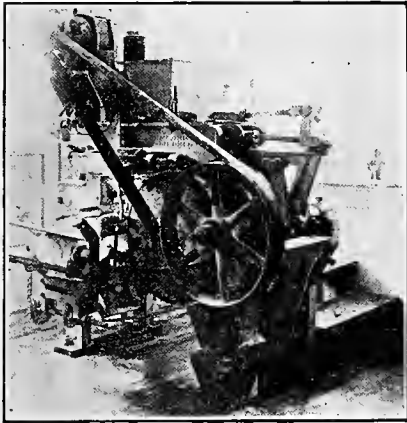
it is sent to the largest electric bread baking oven in the world.

The oven is of double deck construction, with a dividing wall running perpendicularly through the center, from front to back, making four separate compartments in the oven. Each compartment will hold thirty-seven pans of three ten-cent loaf capacity, or one hundred eleven ten-cent loaves. The total number of ten-cent loaves that can be baked at once is 444, or as the bakers rate the capacity of an oven, it will bake 888 five-cent loaves at one time, or approximately 25,750 every twenty-four hours. This, compared with the largest brick oven in the city, which holds 600 five-cent loaves, shows the relative size of the ovens.

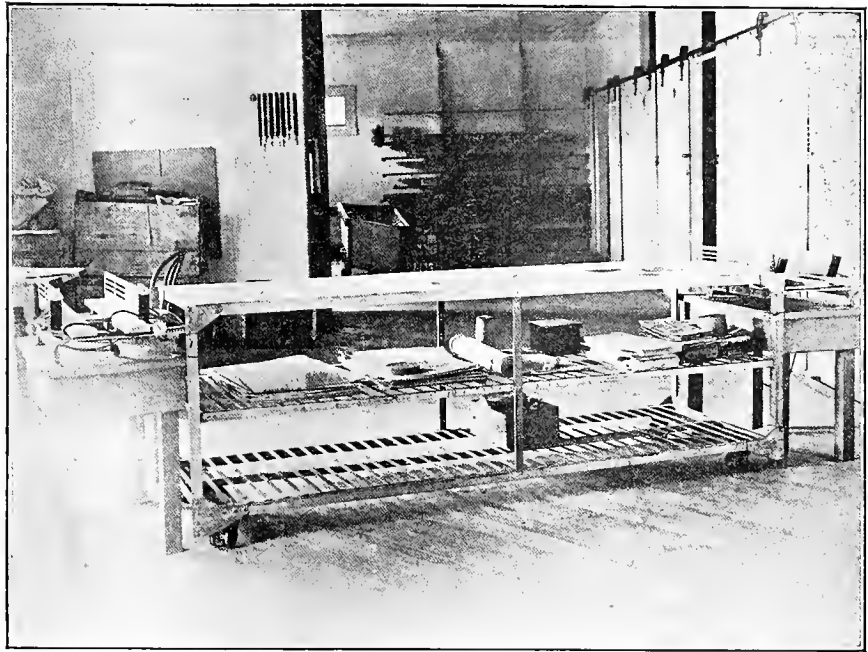
The oven can be filled in about four minutes. To operate it requires little attention, as the heat is supplied from below and from above in each deck. Each section is divided into three parts, each controlled by a three-heat switch, giving to the oven a great variety of heats.

In baking yeast-leavened bread, best results can be obtained by having the oven at 550 deg. F., when loaded, and then allowing the oven temperature to fall until just before unloading, when more heat should be applied to brown the loaf. In baking soda or baking powder breads, the reverse should apply. Put the dough in a moderate oven and increase the heat.

In baking the 22-ounce or ten-cent loaf, about forty minutes is required to thoroughly work the dough. If left in less than this time the loaf is not thoroughly cooked. If left in longer, the moisture is dried out and weight is lost. Repeated tests have shown that with 550 deg. F. at the start, the bread will be at its best after forty minutes baking. It requires about four minutes to unload the oven, making a total of forty-eight minutes required to load, cook and unload the oven. With a few minutes allowed to bring the heat up again, 888 loaves of bread can be turned every fifty minutes.



Automatic Dough Scaler and Cutter.



Electric Wrapper and Sealing Machine.

The construction of this oven is similar to other Hughes ovens. It is finished in galvanized iron, with white enamel front. One standard size door to each compartment. Each compartment has an individual thermometer and steam jet. It is fitted with one and three-quarter inch tile decks and four-inch insulated walls. The heating units are of the open coil type, wound on non-conductor cores.

The rated maximum demand of this oven is 75 kw., but our charts show an actual demand of 88 kw.

The bread, as it is taken from the oven, is put in racks and allowed to cool before going to the bread wrapping machine. The cool loaf is wrapped in a waxed wrapper and run through an electrically heated sealing machine, which heats both ends of the loaf, causing the wax to melt enough to seal the wrapper. These heaters operate with about 250 watts each.

As the bread is pushed from the wrapping machine it is stacked on long boards, holding thirty-six loaves. These boards are then carried to the bread rooms, where they are stored for the morning delivery. At about 5 a. m. the auto delivery flotilla starts out with the early morning orders, each man handling from one thousand to fifteen hundred loaves per day.

The total output in various kinds of bread for the sixteen-hour run totals eighteen thousand loaves per day.

One of the peculiar things that has resulted as a consequence of making an up-to-date bakery, is the increase in business. The output formerly was ten thousand loaves per day from three brick ovens. With the advertising of electrically baked bread, the demand jumped to fifteen thousand loaves over night. There has been a steady demand for the product, until at present the output is eighteen thousand loaves per day and as the baker said, "All sold out."

This modern bakery has been taxed to its capacity to keep up with its demand for electrically baked bread. The housewife has learned the superiority of electrically cooked foods over those cooked otherwise.

MAKING PUBLIC SERVICE BONDS LEGAL INVESTMENTS FOR SAVINGS BANKS.

With their usual keen insight into the future, investment bankers are already seeing the time approaching when properly secured public service corporation bonds will take their place among the selected class of securities in which savings banks may legally invest the savings of their depositors. Expecting this development from the change now going on, the bankers are wisely taking time by the forelock and planning suggestions and recommendations to provide a safe basis whereby public service bonds may enter this aristocratic circle of securities.

Once the barrier is broken down a remarkable impetus to the sale of these securities should set in, for then they will stand on the threshold of a new field, which up to the present has not even been scratched on the surface and which also is capable of absorbing millions of such accounts annually.

All changes come through evolution. Not so long ago little hope was entertained by dealers in public service corporation bonds that state laws could be so amended so as to bring their offerings within the purview of legal bank investments. As long as the majority of securities already legal for savings banks deposits were selling in the market on an income yield which did not make these institutions strain their efforts to produce interest sufficient to take care of their overhead expenses, reserve requirements and pay their depositors from $3\frac{1}{2}$ to 4 per cent, there was little incentive to look around for additions.

But in some states, especially in the Eastern section of the country, a radical change has occurred. By making certain bonds exempt under the income tax and by the rapid accumulation of available loanable capital, bond prices have mounted to such high figures that the income produced hardly makes them attractive for savings banks and they face the need of finding other avenues of investment which will provide them with the necessary margin in income.

Backed by a consistent and favorable record many public service corporation bonds which come within the regulations making them legal investments, should naturally have the first call wherever the states make additions to the list of savings banks securities.

Such an outlook made the investment bankers in session in Cincinnati listen with the closest attention to the report read them by John E. Oldham, chairman of the public service corporation committee, wherein certain rules and regulations were recommended making public service corporation bonds eligible for the funds of the poor man's institutions. At the same time the committee also recommended a more standard form of mortgage to replace the verbose legal one now so much in use and which the average investor no more understands than the Koran unless tutored in the language in which it is written. Investors will commend this recommendation most heartily; may this reform come quickly.

While no law could be so framed as to meet the requirements of the various states, the committee holds that certain fundamentals providing safety to investors could be devised which would go far to help state legislators in their efforts to frame legislation suitable to what they consider their special requirements. This becomes necessary as conditions are not alike in different sections of the country. The committee holds that the face value of securities should not exceed the investment value of the property to make them eligible and that the net earnings should exceed the amount of interest. There is no disagreement on this score or with the further conclusion that in both instances, in the value of the property and in the earnings there should be a considerable margin over the secured creditors' obligations as a buffer to prevent financial default, and if it is unavoidable there remains the recourse of calling upon the junior security holders for funds to protect their investment.

Investigation by the committee leads it to the conclusion that for the purpose of rate making the value of the property has been estimated on the basis of from \$4 to \$5 of property value for every dollar of gross income. So if a property earned annually a gross of \$100,000, the value of its property would be placed anywhere between \$400,000 to \$500,000. Out of the gross earnings there should be earned from 40 to 30 per cent, for the net, which in the first instances would produce out of the \$100,000 gross the sum of \$30,000, and in the latter instance \$40,000, against which earnings bond issues could be created whose interest requirements and other provisions, such as sinking fund needs, would come well within the net earnings. Such a basis of calculation would provide a good starting point in establishing the legal standard for public service bonds. It is also provided as an additional measure of protection in many of the states that the operations and finances of these corporations be under the supervision of state control. After careful consideration the committee decided that bonds returning a net equal to $1\frac{3}{4}$ times the fixed charge, offer a fair margin of safety and that gross earnings equal to four times the fixed charges, offer sufficient evidence of a property value in proportion to the amount of bonds.

In regard to the class of public service corporation bonds eligible for savings banks, the committee believes for the present they should be confined to the

companies furnishing artificial gas, electric light and power, local transportation lines and telephone and telegraph lines, but that no power company producing power for only a few manufacturies, a jitney line not running over tracks and not under a franchise, or any company under the process of construction, should be included, because it considered them as yet too unseasoned; likewise only companies operating in the United States are recommended.

Other minor recommendations are made treating of the franchise requirements, character of bonds, treatment of earnings of corporations. The committee suggested a clarity in the financial reports issued to aid state banking superintendents to determine eligibility of public service bonds as institutional investments.

The committee invited discussion among the members of the investment bankers' association regarding the kinds of companies to be included, size of such companies, limitation of states having utility laws, attempt to impose franchise requirements, exclusion of holding companies, attempts to impose requirements as to maintenance and depreciation, inclusion of senior securities of companies of inferior credit, requirements as to safeguards for escrow bonds, length of time for qualification, and amount of work imposed upon bank commissioners.

In arousing thorough discussion that will bring forth concrete ideas as to how these important matters may be handled, the Investment Bankers' Association will fortify itself to lend valuable assistance to the various states which will at some time in the near future find it expedient to revise their legal requirements governing investments by savings banks and embrace public service corporation bonds.—The Financial World.

PLAN TO FLOOD LIGHT STATUE OF LIBERTY

The Statue of Liberty, gift of the Republic of France to the United States, will be illuminated for the first time with its new permanent flood-lighting on the night of December 1st, according to a program just announced by the Society for Electrical Development. Through the activities of the society, in co-operation with the New York World and with leading government officials and electrical engineers, plans have been made to lay a cable from the New Jersey shore to Bedloe Island, which will carry current for the illumination. This will provide all Bedloe Island, where the statue is located, with central station service instead of the isolated plant as was originally proposed.

This installation will endure as a national exhibit of central station service and, in a picturesque way, be an inspiration for flood-lighting civic buildings, arches, statuary, etc., throughout the cities of America. In furthering this project, the society's general manager, J. M. Wakeman, has addressed letters to all the 268 America's Electrical Week committees earnestly requesting each committee to set aside Saturday, October 28th, as "Liberty Day." This date is the thirtieth birthday of the Goddess of Liberty, and it will be the last day upon which donations will be received to flood-light the statue. Electrical engineers will begin the installation directly after so that the AEW inauguration may be run off according to the society's program.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

"The only form of price-fixing which is right—the fixing of prices by each concern at a level which shows sure profit, based on absolute knowledge of what everything costs."—James H. Collins.

* * *

Over 97 per cent of all possible customers within 300 ft. of the Utah Power & Light Company's lines of less than 11,000 volts are using that company's service. The load builders are now going after the other three per cent.

* * *

Preliminary work has been started by the Union government on the Hartebeestpoort irrigation scheme in the Transvaal, South Africa. A concrete dam 159 ft. high is to be constructed so as to store five million cubic feet of water.

* * *

The railways of the United States have a debt of ten billion dollars and the stock amounts to about six billions. Net returns for the last fiscal year, though the largest in history, were equivalent to about 5½ per cent on the property used by the public.

* * *

In the great game of business only eighteen per cent failures are due to causes outside the business itself. The other sixty-five per cent can be definitely traced to incompetence, lack of experience, insufficient capital, lack of personality or bad habits.

* * *

Football is the latest outdoor sport to be electrified. The Harvard Stadium is to be flood-lighted during varsity practice in the late afternoon. At a preliminary try-out a battery of eleven lighting units furnished sufficient foot candles for the squad of eleven football players.

* * *

"Of all the inventions, the alphabet and the printing press alone excepted, those inventions which abridge distance have done most for the civilization of our species. Every improvement in the means of locomotion benefits mankind morally and intellectually,"—Lord Macaulay.

* * *

The Electrical Supply Jobbers' Association has postponed action indefinitely on a plan to form eight geographic sections which were to meet locally at frequent meetings and nationally at semi-annual conventions. It is probable that objection to this plan will be removed in the near future.

* * *

The next step in the evolution of public utilities, in the opinion of W. W. Freeman of Cincinnati, will be into an era of recognition. They have already passed through the stages of invention and exploitation and are now in the age of regulation. The utility has learned that its first function is to be a faithful public servant and the people are beginning to realize that there is an equally strong duty on the part of the public to permit the utility a fair and reasonable return for the service rendered.

Electricity is being rapidly adopted throughout China. The present high price of kerosene makes electric lighting economical and motors are displacing manual labor in many small factories. The mint at Mukden is the first to adopt the use of electric power.

* * *

The crop of newly-fledged valuation engineers and rate experts who offer to obtain reductions in rates for electric service on the basis of payment proportionate to reduction are a species of highwaymen whose practices are hard to curb. An enlightened public opinion seems to be the best remedy.

* * *

The largest dam in Europe has just been completed by American engineers across the chasm through which the Noguera Pallaresa River flowed near Barcelona, Spain. It is a concrete structure 330 ft. high, 700 ft. long, 230 ft. thick at the base and 14 ft. thick at the top. The water is used for power and irrigation.

* * *

The possibilities of using electric railways in plans for coast defense were explained at the annual convention of the American Electric Railway Association by W. K. Wilson, captain of the Coast Artillery Corps. Guns mounted on cars could be used to prevent a landing at unfortified places and many supplies can be quickly transported to fortifications by electric railways.

* * *

Present shipments of California crude oil exceed production by over a million barrels a month. Since July, 1915, the stock has steadily lessened from sixty million to less than fifty million barrels. In this same period the price of heavy crude oil at the wells has more than doubled, now being close to eighty cents. The seven thousand operating wells in the state are producing about eight million gallons monthly.

* * *

"Organization is based on the division of aggregate effort into parts and the selection of persons who have a special fitness for the performance of each subdivision of the work. Sumner expresses this idea when he says, 'Combination is of the essence of organization; an organization is the great device for increased power by a number of unequal and dissimilar units brought into association for a common purpose.'"

* * *

The largest order ever placed for a single commodity was the sale recently of 448,000,000 pounds of copper to Europe, with deliveries during the first six months of 1917. This copper was sold at from 26 to 27 cents a pound, the transaction involving a total outlay of about \$125,000,000. The order will call for about one-quarter of this country's entire refining output of metal during the first six months of next year and makes altogether 900,000,000 pounds of copper that has been taken in the United States for the account of foreign buyers.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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Engineers are anxious that their calling be recognized as a profession. They desire public appreciation of their work. But sometimes they fail to realize the criterion by which they must be judged.

Engineering: A Profession or A Trade?

The so-called learned professions, theology, law and medicine,—have the unselfish service of mankind as the basis of their claim to this distinction. If a physician practices merely for the money there is in it, strictly speaking, he is not a professional man. Lawyers, doctors and even ministers decry the tendency of their professions to degenerate into trades. In the minds of most people the law has already tumbled from its pedestal. There are still many doctors, however, who are devoting themselves to the good of mankind and the great majority of ministers are above suspicion in this respect.

Engineers, as a group, conform well to this high standard for a profession. They are deeply interested in their work for its own sake and not for the money there is in it. They have set up a code of ethics of the highest grade and they are thoroughly imbued with the idea that their work is public in character. By maintaining this attitude of mind they will earn the right to be classed as professional men.

The engineering school of today is like the legendary Grecian highwayman, Procrustes, who tied his victims to an iron bed, and, as the case required, either stretched or cut off their legs to adapt them to its length. The college solves only half the vocational problem. It gives vocational counsel and training but neglects vocational analysis and placement.

Procrustean Education

The engineering schools fit men for a practical life of useful citizenship but do not fit their curricula to the peculiar needs of each man. They deal with groups and not with individuals. Students are allowed to take courses for which they have no natural aptitude. Certain courses are prescribed regardless of the students' ability and he is disbarred from others in which he might show great proficiency.

In the light of recent successes in the scientific employment of men it would seem that similar methods might be adopted by the universities in analyzing their matriculants. It is a notorious fact that many men, who prepare for engineering careers drift into other fields later in life. While an engineering education is a good foundation for many other lines of work, a more specific preparation based upon scientific vocational analysis, would lead to an earlier success. Conversely there are many misfits in engineering occupations.

The other factors in which colleges seem remiss are in vocational placement. Like a salesman who forgets a customer after he has sold him a bill of goods, the average school allows its graduates to shift for themselves. Instead of following up its alumni, advising them of positions and trying to help their advancement,

the college devotes all its energies to turning out new batches of men.

These two neglected functions, for the average engineering school, might well be assigned to one man who is an expert on human analysis. By conferring with the freshmen he can advise them what to study and by corresponding with the graduates he can place them where they can apply their knowledge to the best advantage. This is a new field that seems worthy of attention.

Everyone who has poured ether into the palm of the hand will recall that a sensation of cold is immediately produced. This is due to the fact that ether rapidly evaporates at the temperature of the body and, in order to pass from the liquid into the gaseous state, it must absorb quickly a large quantity of heat. This heat is as a consequence drawn from the palm of the hand and the result is that the palm of the hand feels cold.

Superiority of Electricity for Ice Rinks

This principle is made use of in the indirect system of refrigeration described on another page of this issue for the creation of an artificial ice pond for skating. In that instance liquid ammonia is used instead of ether and brine is the surrounding medium instead of the palm of the hand. All that is principally necessary in addition to the ammonia and brine, in order to make a going ice plant, is to install a pump, electrically driven, to cause the cold brine to circulate when refrigeration is desired and at the same time provide some means of compressing the ammonia gas formed in expansion from its liquid and then pump this resulting liquid back again into the receptacle used in the ice-making cycle.

In the operation of the modern ice rink, the condition of the weather has something to do with the energy required to keep the rink in proper working order, but by far the more important factor to know is the number of people utilizing the rink at any given time.

Ice skating in its ultimate analysis is nothing but the rubbing of steel under pressure against an icy surface. This of course results in the creation of friction and friction is nothing but the dissipation of heat. A vast difference, then, is to be expected in the refrigeration required to maintain an ice coating in a skating ring when only one hundred people are utilizing its surface as compared to the requirements under a bristling, rollicking crowd of fifteen hundred. And this proves to be the case in actual operation.

Right at this point, then, is where the delicate control of electrically operated refrigeration plants are making their lasting gain in popularity over any other known source of generation. It is simply surprising to see to what delicate shades of temperature a rink may be regulated under such control.

It is a well-known fact that an ice rink best develops an ideal surface quality when its temperature is at the melting point of ice—namely at 32 degrees F. At this temperature any unevenness in surface rap-

idly levels itself and at the same time a certain resiliency in the ice is attained that is not found to exist at other temperatures.

For such delicate control the electrical method proves to be without a peer and as a consequence once again the central station is to find in the increasing popularity of the artificial ice rink, another profitable and growing source of revenue.

Occasionally some one states an obvious fact so sententiously that people wonder why its truths had not

A Platinum Rule of Conduct

been given greater recognition before. Such a statement was recently made by Mr. George L. Dillman, a well-known consulting engineer in an address before the San Francisco section of the American Society of Civil Engineers. Strangely enough it has to do with ethics rather than engineering, though coming as the result of a rich and varied engineering experience.

The essence of his discourse was that "authority should lie with responsibility." Responsibility should not be imposed without a corresponding authority imposed, authority should not be exercised without a proportionate assumption of responsibility. Observance of this principle brings success into every human relationship, neglect causes failure.

Its truth is well illustrated by its violation. In the home, disputed authority or shirked responsibility causes discord; in business, "butting in" or shirking results in failure; in politics, authority without responsibility brings inefficiency.

Many a man is given a job when he cannot make good because his hands are tied. He has the responsibility but is without the authority to execute it. Conversely, authority without responsibility is equally as bad, as may be exemplified by a public service corporation or a labor union.

Responsibility is negative, downward, centripetal, —authority is positive, upward, centrifugal. Their balance gives harmony, their unbalance discord. Success depends upon their equilibrium, an excess of either causes failure. It is the willingness and ability to assume the burden that measures a man's capacity for success. It is the amount of authority granted him that determines that success.

A man's income is usually measured by the responsibility he carries. In this sense details are not necessarily responsibilities. The successful man of heavy responsibilities delegates the details to assistants who are vested with authority to carry them out. But for every responsibility shifted there must be a compensating shift of authority.

Thus it is seen that Mr. Dillman's principle is only a special instance of the great law of compensation. As a rule of conduct it is so invariable and so precious that it might well be called the platinum rule as compared with the Golden Rule. Let response to responsibility always be met by authorization of authority—never delegate authority without specifying responsibility.

PERSONALS

Chas. S. Pflasterer, of the National Carbon Company, is at San Francisco from Cleveland, Ohio.

G. L. Oman, of the General Electric Company, has returned to Portland from a visit to California.

E. C. Jones, chief gas engineer Pacific Gas & Electric Company, has returned to San Francisco from Chicago.

H. B. Squires of the H. B. Squires Company, has returned to San Francisco from an automobile trip to Los Angeles.

W. H. Trimm, secretary and general manager of the Monarch Telephone Manufacturing Company at Fort Dodge, Iowa, is at San Francisco.

C. G. A. Baker, vice-president and treasurer of the Baker-Joslyn Company, has returned to San Francisco from a short business trip to Los Angeles.

Roy Worth, salesman with Pacific States Electric Company, at Seattle, and H. C. Chapman, at Los Angeles, were at San Francisco during the past week.

H. L. Jackman, manager of the Western States Gas & Electric Company of Enreka, Cal., recently returned from an extended business trip throughout the East.

R. D. Holabird, of the Holabird-Reynolds Company, will return to San Francisco from an extended business trip throughout the East about the first of November.

F. Getter battery engineer of the Spokane Inland Empire Railroad, has recently returned from Nogales, where he had command of Company C of the Idaho Infantry.

W. D. Peaslee, electrical engineer, Oregon Agricultural College, read a paper on 'Electric vs. Steam Logging,' before the Pacific Logging Congress at Portland, this week.

H. L. Gift, formerly connected with the sales force of the Pacific States Electric Company at Seattle, has recently joined the sales force of the Baker-Joslyn Company.

A. M. Irwin, assistant to the treasurer of the Westinghouse Electric & Manufacturing Company, of San Francisco, recently returned from a business trip to Los Angeles.

C. C. Hillis, manager of the Electric Appliance Company, recently returned to San Francisco from the East, where he attended the convention of the Electrical Supply Jobbers at Cleveland.

Thomas Finigan, manager sales department American Brakeshoe & Foundry Company, San Francisco, has been re-elected president of the American Electric Railway Manufacturers' Association.

Thos. Dooling, of the Electric Storage Battery Company of San Francisco, who was with the Signal Corps of California on the border, is expected to be back on the job about the first of November.

Miles F. Steel has succeeded F. H. Poss as Pacific Coast manager of the Benjamin Electric Manufacturing Company. C. O. Martin recently arrived at San Francisco to act as salesman in the Western territory.

F. D. Fagan, sales manager of the lamp department of the San Francisco office of the General Electric Company, has recently been appointed district sales manager for the Pacific Coast of the Edison Lamp Division.

Henry L. Doherty of New York has been elected reigning Jupiter of the Jovian Order; J. S. Colwell of Seattle, member of the Congress for the twelfth district, and T. E. Collins of San Francisco, for the thirteenth district.

John A. Britton, vice-president and general manager Pacific Gas & Electric Company, who was operated on for appendicitis about the first of this week, is getting along nicely, and expects to be out about the last of next week.

L. G. Cushing, traveling salesman for the Connecticut Electric & Manufacturing Company, is a recent visitor on the

Coast. Mr. Cushing is making his semi-annual tour of inspection of the branch offices, and is now at Los Angeles.

F. H. Poss, who has been the Pacific Coast manager of the Benjamin Electric Manufacturing Company during the past ten years has been made sales manager of the company at Chicago. He leaves San Francisco this week to assume his new duties.

L. S. Ruble of the Northwestern Electric Company, has been elected president of the recently organized Electrical Storekeepers' Association of Portland, Ore.; C. H. Still of the Pacific Power & Light Company, first vice-president; S. F. Clark, of the S. P. & S. Railway Company, second vice-president; G. O. Hunter of the Portland Railway, Light & Power Company, treasurer, and J. G. Weber General Electric Company, secretary.

W. A. Motter, designer of direct current apparatus for the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has returned to the East after completing the installation of a big motor generator set for the Pacific Electric Company at Los Angeles. The Allis-Chalmers people have recently completed the sale of a 4000 h.p. unit to the Snow Mountain Power Company at Ukiah. This includes generator, water-wheels, etc.

OBITUARY.

Harry H. Gribben, superintendent of the Oakland, Cal., factory of the Standard Underground Cable Company, died suddenly September 26th at his home in Oakland, age 56 years, 8 months and 7 days. Mr. Gribben was a native of Pittsburgh, Pa., and lived there until 1899, when he moved to California to take charge of the factory which the Standard Company had then just completed. Previous to this he was general foreman in the company's Pittsburgh factory. He had been in the employ of the Standard company for over 30 years and was one of its most faithful, loyal and competent superintendents, and a man who by his personal qualities endeared himself not only to his business associates but to every one with whom he came in contact. At a recent meeting of directors suitable resolutions were passed expressing the Standard Company's sense of loss in the passing away of one of its oldest employes in point of service.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

President-elect Newbert started his term of office with an interesting meeting on October 18th. Believing that the success of the League is largely dependent upon strong committee work he announced the following personnel for his several committees:

Finance—W. S. Berry, R. F. Behan, T. W. Simpson.

Public Affairs—A. H. Ellicott, P. J. Ost, C. F. Butte.

Visiting—W. R. Dunbar, A. E. Drendell, R. G. Guyett.

Reception—H. P. Pitts, E. O. Shreve, D. E. Harris, P. Decker, E. E. Browne.

Publicity—F. M. Cutting, A. H. Halloran, T. E. Collins.

Entertainment—N. J. Prendergast, H. E. Fisher, M. S. Orrick.

Membership—W. F. Neelands, F. E. Boyd, G. L. Galbraith.

Mr. Walter K. Brown, district manager of the Crocker-Wheeler Company, as chairman of the day, introduced Dr. J. H. Graves, who read an instructive address on the negative side of Social Insurance. He explained the purpose of contemplated legislation to provide compulsory insurance for salaried workers by a plan which includes the deduction of a small per cent of their wages, by a tax on the employer and a contribution from the state. After briefly stating its origin in Germany he put five pertinent questions. Is such a law needed? Do the beneficiaries want it? Could it be amended so as to be objectionable to all? What effect will it have on the medical service rendered the people? What effect will it have on

those who do not come within its provisions? Discussing these at length he argued that such a law was not needed, not wanted, and was in many ways objectionable and undesirable. He advised that the matter not be acted upon hastily but that it be given future study and thought. C. F. Butte supplemented the speaker's remarks by stating that after careful study a committee of the building trades employers had found the proposal unwise. At the conclusion of the meeting the speaker was extended a vote of thanks.

Oregon Society Engineers.

At the October 20th meeting the speaker of the evening was Mr. Frank F. Sinks, Mem. Am. Soc. C. E., and engineer and general manager of the Pacific Coast Steel Company. The subject was "Steel Making on the Pacific Coast," illustrated by moving pictures and stereopticon views which showed the actual operations in the manufacture of steel at the Seattle plant of the Pacific Coast Steel Company. He stated that they used electric power wherever they could and that they now had a 1200 h.p. and an 800 h.p. motor operating rolls. The society endorsed the road resolution passed by the county judges and commissioners association of Oregon in regard to road legislation. The resolution in substance is as follows: "A formal request to the Bureau of Public Roads in the Department of Agriculture, Washington, D. C., for a code to cover all the phases of road legislation in the state of Oregon."

Los Angeles Jovian Electric League.

October 18th was observed by the League as "Edison Day" and a large number of Jovians and their friends assembled at the luncheon to pay tribute to the great master of the electrical industry. C. E. Spaulding, local sales manager of the Edison Lamp Works and General Electric Company, was master of ceremonies and presented a well-balanced and interesting program. A. E. Morphy, the newly-elected President, wielded the gavel with considerable energy and kept things moving with alacrity and dispatch. He is particularly proficient in the art of collecting fines from the members, which augurs well for a successful season from a financial standpoint at least. Geo. P. Barton, former general patent attorney for the Western Electric Company at Chicago, and prominent patent attorney, was speaker of the day. His subject was "Some Early Electric Patent Decisions." Mr. Barton, in his legal capacity, was involved in some of the infringement and interference suits in the days of the old Brush and Thomas Houston Electric Company, and he told some interesting facts concerning the suits affecting Mr. Edison's patents. He stated that his lamp invention was involved in 22 different cases, and although patents were issued in 1880, it was not until 1891 that a favorable decision was affirmed on appeal. Mr. Barton was followed by James Lighthipe of the Southern California Edison Company, who was associated with Edison and with him at the time the electric lamp was invented. In a brief talk, he told of some of his experiences.

NEWS OF CALIFORNIA WATER COMMISSION.

Wm. M. Hunt, Jr., of Victorville, on behalf of the proposed Mojave Irrigation District, now in process of formation, has applied for permission to appropriate 300 cubic feet per second of the waters of Deep Creek and west fork of the Mojave River, tributary to Mojave River in San Bernardino county. The plan proposes a monolithic gravity concrete dam, impounding 100,000 acre feet of water and main canals thirty miles long, for the irrigation of 50,000 acres.

E. E. Pollock of Redding has applied for permission to appropriate for agricultural purposes, 15 cubic feet per second of the waters of the east fork of Stillwater Creek, tributary to the Sacramento River. It is proposed to store water by means of three dams built of gravel and clay with concrete core.

The main ditch is given as a mile long. The estimated cost is \$2000 and the number of acres to be watered is 400.

J. Overholtzer of Glenn, Glenn County, has applied for permission to appropriate 60 cubic feet per second of the waters of the Sacramento River in Glenn County. The proposition is to divert the water by means of electrically driven pumps discharging into a main canal five miles in length. The estimated cost of the works is given as \$15,000 and the number of acres to be watered as 7000, situated in Glenn and Colusa counties.

The Landis Bros. of San Francisco, have applied for permission to appropriate 100,000 acre feet per annum of the waters of Dry Creek, tributary to Mokelumne River, in San Joaquin and Sacramento counties. The diversion proposes a concrete multiple arch dam 60 ft. high, 1400 ft. on top and 1200 ft. on bottom, which shall serve the purpose of both a storage and diversion dam. This it is proposed to locate on the Arroyo Seco Ranch. The estimated cost of the project is given as \$1,000,000, and it is contemplated to water 100,000 acres. The commission has allowed the applicants until May 1, 1917, to file complete data and maps.

W. F. Fowler of Willows has applied for permission to appropriate 250 cubic feet per second of the waters of the Sacramento River for rice culture on 14,000 acres. The water will be raised by electrically-driven pumps to the main canal which is given as 10 miles in length. The proposed works will cost, at an estimate, \$180,000.

The Peoples Water Company of Oakland has applied for permission to appropriate 5500 million gallons of the waters of San Pablo Creek in Contra Costa county to supply Oakland, Berkeley, Alameda, Richmond, Emeryville, Piedmont, San Leandro, Albany and contiguous incorporated territory. The proposed works are given as follows: Dam, 160 ft. high, 1250 ft. on top, hydraulic earth fill with concrete core-wall, capable of impounding 40,000 acre feet; main ditch and pipe line, 15,000 ft. long. The application states that applicant is ready to begin construction January 1, 1917, and complete same January 1, 1920. The estimated future requirements of the cities are given as follows: In 1920, 7230 million gals.; in 1924, 9130 million gals.; in 1928, 11,610 million gals.; in 1930, 12,900 million gallons.

J. G. Van Zandt of Forest Home, San Bernardino county, has applied to appropriate waters of the north tributaries of Mill Creek, tributary to Santa Ana River, to the amount of 25 cubic feet per second for the purpose of generating power for manufacturing purposes. The enterprise is known as the San Geronio power project. There is a proposed pipe line five miles in length, and a fall of 2230 ft., to be utilized for the generation of 6333 theoretical horsepower, at an estimated cost of \$500,000. The water is to be returned to the stream after use for power. Work on the project began in 1913 and the application sets forth that it will be completed in 1919. The application further says: This application is made to initiate an adjudication by the water commission, of the rights of J. G. Van Zandt, who has purchased the rights previously held by C. G. Baldwin (under previous law conditions which have been fulfilled), but whose federal permit was revoked October 16, 1914, on account of non-payment of fee, said Van Zandt holding permit from federal offices for use of water, claims this water under previous filing and construction work, as required by previous law. Should the water commission find this sufficient evidence of right of use, this application may be dropped.

Frank M. Ish of Oakland has applied for permission to appropriate all the un-appropriated water, with a minimum of 100 second feet, of the waters of the South Fork of the Merced River in Mariposa county for the generation of electric power. The application sets forth a proposed flume and pipe line 8 miles long, to be known as the Tioga Flume and Pipe Line, and states that the fall to be utilized is 1600 ft.

for the generation of 10,000 theoretical horsepower. The water is to be returned to the stream after use for power. The estimated cost is given as \$1,500,000. The power is to be for general distribution. The application states that work will commence June 1, 1917, and be completed June 1, 1919.

NEWS OF IDAHO PUBLIC SERVICE COMMISSION.

A certificate of public convenience and necessity has been issued to the Idaho Power Company for serving Filer, Twin Falls County, Idaho.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

On October 30 and November 1 the commission will hold hearings in Olympia to go over with the gas, water and electric company representatives all questions relating to such concerns before printing the new set of rules and regulations. The copies of the printed rules and regulations have become exhausted and at those sessions it will be determined whether or not any changes should be made.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Halfmoon Bay Light & Power Company has applied for permission to sell its properties to the Great Western Power Company.

The Pacific Gas & Electric Company has asked permission to use the proceeds now on hand from the sale of its general and refunding mortgage gold bonds and first preferred stock to reimburse its treasury \$1,068,803.86 for expenditures for improvement and betterment. On January 3 of this year the commission authorized the company to issue and sell first preferred stock in the amount of \$2,500,000 at 90, and to issue and sell bonds to the amount of \$2,000,000 at 85. The company says it contemplates an expenditure of \$3,150,000 in the future.

PUBLIC SAFETY HEARINGS.

The Industrial Accident Commission has arranged for four Public Safety Hearings in San Francisco, as follows: Window Cleaning Safety Orders, Monday, October 30th; Trench Construction Safety Orders, Tuesday, October 31st; Air Pressure Tank Safety Orders, Wednesday, November 1st; Electrical Utilization Safety Orders, Thursday, November 2nd. These public hearings will be held in Room 407, Underwood building, 525 Market street, San Francisco, commencing at 10 a. m. for each hearing. Similar public hearings will be held in Los Angeles, as follows: Window Cleaning Safety Orders, Monday, November 13th; Trench Construction Safety Orders, Tuesday, November 14th; Air Pressure Tank Safety Orders, Wednesday, November 15th; Electrical Utilization Safety Orders, Thursday, November 16th. These public hearings will be held in Room 405, Union League building, Los Angeles, commencing at 10 a. m. for each hearing.

The tentative Trench Construction Safety Orders give standards for sheeting, shoring and bracing trenches and define where they will be required. There were 18 fatal trench construction industrial injuries in 1915, 9 permanent injuries and 546 temporary injuries. The total compensation paid in the 27 fatal and permanent injuries were \$6,854.86. The medical payments amounted to \$1,231.

The tentative Electrical Utilization Safety Orders cover safety standards for equipment, storage batteries, transformers, lightning arresters, conductors, switches, fuses, switchboards, motors and motor-driven machinery, arc welding, lighting fixtures and signs, portable devices, cables and connectors, etc. The orders were based on the electrical utilization section of the proposed National Electrical Safety Code prepared by the U. S. Bureau of Standards. There were 25 fatal electrical industrial injuries in 1915, 9 permanent injuries

and 384 temporary injuries. Total compensation payments made in the 34 fatal and permanent injuries amounted to \$15,175.91, and medical payments in these cases amounted to \$16,629.92.

NEW CATALOGUES.

Catalogue No. 1, from Kellogg Switchboard & Supply Company, 86 Third street, San Francisco, presents valuable data on line construction material, "everything to connect the 'phone to the 'board."

"Handy Electric Wiring Devices" are illustrated and described in Catalogue No. 24 from Pass & Seymour, Inc., of Solway, N. Y. The most noticeable feature is a comprehensive charting of interchangeable parts. This shows the several devices that can be assembled from the different parts and is conveniently arranged for rapid reference.

As part of a comprehensive campaign to interest farmers in electrical devices, the Western Electric Company, is widely advertising "The Farmer's Electrical Handbook," a text written in an admirably clear and able manner. Dealers are advised as to those who receive the book and a folder entitled "New Customers for" is being sent to contractors and central stations.

"Cashing in On A. E. W." is the subject of an attractive folder sent by the Western Electric Company to electrical dealers. It announces various sales helps which are available to promote the use of sewing machine motors, washing machines, cleaners, irons, ranges and vibrators. It also gives definite plans and suggestions for cashing in on America's Electrical Week.

PUBLICATIONS RECEIVED.

Scientific Paper No. 292 from U. S. Bureau of Standards, "International System of Electric and Magnetic Units," discusses proposals for changes.

A new publication of the Bureau of Standards (Scientific Paper No. 290) entitled "A Variable Self and Mutual Inductor," outlines the development of a new form of instrument for varying the self inductance of a circuit, or the mutual inductances between two circuits.

Scientific Paper No. 291, from U. S. Bureau of Standards, illustrates and describes "A System of Remote Control for an Electric Testing Laboratory."

The Associated Manufacturers of Electrical Supplies, 62 Cedar street, New York, has issued a folder under the title, "What It Has Accomplished," noted as general secretary's Bulletin No. 4. The folder explains the objects of the Association, the results, activities, affiliations, various sections, etc. The officers are: President, R. K. Sheppard; vice-president, H. B. Crouse; treasurer, J. W. Perry; general secretary, Charles E. Dustin; board of governors, A. W. Berresford, Cutler-Hammer Mfg. Co., Milwaukee, Wis.; Charles Blizzard, Electric Storage Battery Co., Philadelphia, Pa.; Leroy Clark, Safety Insulated Wire & Cable Co., New York; H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.; L. W. Downes, D. & W. Fuse Co., Providence, R. I.; D. C. Durland, Sprague Electric Works, General Electric Co., New York; J. J. Gibson, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.; E. B. Hatch, The Johns-Pratt Co., Hartford, Conn.; H. R. Holmes, R. Thomas & Sons Co., East Liverpool, Ohio; J. F. Kerlin, National Carbon Co., Cleveland, Ohio; J. W. Perry, H. W. Johns-Manville Co., New York; Warren Ripple, George Cutter Co., South Bend, Ind.; W. C. Robinson, National Metal Molding Co., Pittsburgh, Pa.; B. E. Salisbury, Pass & Seymour, Inc., Solway, New York; R. K. Sheppard, Simplex Wire & Cable Co., Boston Mass.; counsel, Thomas M. Debevoise, 62 Cedar street, New York.



NEWS NOTES



INCORPORATIONS.

SALINAS, CAL.—The Pacific Telephone & Telegraph Company was the only bidder for a telephone and telegraph franchise and its bid was accepted.

ELLISPORT, WASH.—The Vashon United Telephone Company has been incorporated here for \$50,000 by C. H. Newcom and C. A. Collins, Ellisport, and C. F. Van Olinda, Portage.

STANWOOD, WASH.—The Peoples' Telephone Company has been incorporated here with a capitalization of \$10,000 by Peter Henning, John Ellingsen, S. J. Barnum, C. Jorgenson and Edwin Egge.

SAN FRANCISCO, CAL.—The Victor Electric Corporation of California has been incorporated with a capital stock of \$25,000, by H. J. Ingersoll, W. D. Eddy, W. G. Hargis, Jr., G. L. Bush and L. C. Shingle.

FINANCIAL.

CLE ELUM, WASH.—Bids will be received up to Monday, November 6, at 8 p. m. for the purchase of \$5000 in bonds, proceeds to be used in part for the construction of municipally owned electric light and power distributing system for the town.

SALEM, ORE.—The Portland Railway, Light & Power Company's deficit on its railway, light, power and gas operations totaled \$130,260.42 in the year ending June 30, according to its annual report on railway operations, filed with the public service commission. The loss was \$153,411.91 greater than during the previous year. Revenues from railway operation totaled \$3,254,076.77, a decrease of \$209,097.32 over the previous year. Railway operation expenses totaled \$2,051,798.92, a decrease of \$21,148.90. The net revenues from railway operations totaled \$1,202,277.85, a decrease of \$187,948.42 over the previous year. Auxiliary operating revenues, derived from light, power and gas, were \$1,976,216.77, a decrease of \$44,817.22; operating expenses, \$780,115.59, a decrease of \$18,830.41, and net operating revenues, \$1,865,420.86, a decrease of \$120,407.48. The operating income from all sources of revenue totaled \$1,865,420.86, a decrease of \$120,407.48.

ILLUMINATION.

EPHRATA, WASH.—The council has decided to place electric street lights in the business district.

JUNEAU, ALASKA.—Geo. Irving and Frank L. Clark have asked for a franchise to erect a gas plant.

CAMAS, WASH.—Oak Park district residents have taken steps toward securing a street lighting system.

WINTON, CAL.—The San Joaquin Light & Power Company is seeking to establish a lighting district in and around Winton.

CEDARDALE, WASH. A petition is being circulated for an electric lighting system. Mrs. Raymond Vashaw is promoting the matter.

GILMORE, IDAHO.—Bids are being called by the Pittsburg & Idaho Mining Company at this place for installation of a new power plant to furnish electric energy for the mine.

LOS ANGELES, CAL.—An ordinance has been adopted by the city council ordering the installation and furnishing of electric current for the lighting of Sixth street between Palos Verde street and Pacific avenue.

SEATTLE, WASH.—The Bremerton city council has given the franchise for the construction of a gas plant there to E. L. Blaine of the Graff Construction Company, Seattle, who will invest over \$150,000 in a new plant at once.

PORTLAND, ORE.—The Board of County Commissioners will receive bids at Room 200, Court House, Portland, until

October 27 for copper conductors, lamp post brackets, transformers and fixtures for lighting the Interstate bridge.

MIAMI, ARIZ.—J. W. Young, manager of the Midland Land Company, has not decided yet what arrangements will be made for electric lights for the new townsite, but states that if necessary the company will install its own plant.

BEAUMONT, CAL.—Work has been started on the pipe line from this city to Banning, which is being installed by the Riverside County Gas & Power Company, recently organized to convey gas from its plant in this city to the Banning system.

PE ELL, WASH.—The light situation in Pe Ell was canvassed the first of the week by several officials of the North Coast Power Company, with a view to establishing a light plant in the town. Their decision will be made known later. The estimated cost of the new plant is \$17,000.

OCEANSIDE, CAL.—Sealed bids will be received up to October 25th for lighting the streets of Oceanside, for a period of five years beginning December 1, 1916. The person or corporation to whom the contract is awarded shall at his own expense furnish, place, install and maintain wires, lamps, poles and all other equipment required for said lighting, in accordance with plans on file with the city clerk.

LOS ANGELES, CAL.—The board of public works will receive up to October 30th, sealed bids for the installation of the necessary appliances and for furnishing the necessary electric current and maintaining said appliances for a period of one year, for lighting Adams street, between Figueroa street and Hoover street. A certified check for 10 per cent to accompany each bid. The right is reserved to reject all bids.

LOS ANGELES, CAL.—Plans to place this city ahead of any other in the matter of ornamental lighting, assumed tangible form at a recent meeting of business men. A special committee was named to further a movement for the early action and to the committee was added another advisory committee that will keep in touch with the plans for the initial installation of lights and foster the adoption of the system on other streets of the city. Initial installation will be made upon plans to be designed by W. D'A. Ryan.

TRANSMISSION.

PORTOLA, CAL.—The owners of the Walker Copper mine, 25 miles from Portola, are preparing for the construction of an extensive power plant.

KINGMAN, ARIZ.—The California & Nevada Telephone Company has a force at work digging trenches for underground conduits which will eliminate the placing of the telephone wires on poles.

DEER PARK, WASH.—The Deer Park Lumber Company has petitioned the county commissioners for a franchise to construct an electric light and power line along the road entering Deer Park, from the lumber company's plant.

GILMORE, IDAHO.—Bids are being received by the Pittsburg Idaho Mining Company at Gilmore, Idaho, for the installation of a new power plant to furnish electrical energy for the mine. The machinery will include hoist, compressor, pumps, machinery for ventilation, dynamo and electric lighting.

SAN DIEGO, CAL.—Managing Director Clayton of the San Diego Electric Railroad Company, has announced that a decision has been reached to construct a new substation which will increase the power needed to give more rapid service between San Diego and Chula Vista. Work will be started at an early date.

MARSHFIELD, ORE.—Manager A. L. Martin of the Oregon Power Company, has been authorized to install a new

transmission 11,000 volt line between the C. A. Smith mill and the company's substation at Porter. The installation will necessitate a number of important transformers. The work will cost about \$18,000.

KINGMAN, ARIZ.—Notice has been given that it is the intention of the board of supervisors to grant a franchise to the Oatman Hydroelectric Power Company, to acquire and operate a public utility in Mohave county, for generating electric power to be transmitted and consumed in Oatman mining district and neighboring sections of the county.

LOS ANGELES, CAL.—The city council has resolved that it is necessary for municipal purposes that a permanent easement and right of way over certain property be acquired by condemnation, for the purpose of constructing, maintaining and operating electric power transmission lines, together with operation of said lines, in connection with proposed electric system, together with telephone lines, extending from a point in Inyo County to a point in Los Angeles County.

LOS ANGELES, CAL.—A proposition has been made that the city purchase for \$12,561,500 the distributing systems of the Southern California Edison Company, the Pacific Light & Power Company and the Los Angeles Gas & Electric Company in the city of Los Angeles. This carries with it a 10-year contract for the city to buy from the corporations at 1 cent per kw.-hr. all the power required in excess of its own hydroelectric production. By making an initial payment of \$3,561,500 the balance with six per cent interest thereon can be taken care of by revenues during the next ten years. The property to be purchased includes the steam plant of the Los Angeles Gas & Electric Corporation. Chief Engineer E. F. Scattergood opposes paying more than \$10,000,000 for the properties.

TELEPHONE AND TELEGRAPH.

BARSTOW, CAL.—Arrangements are being made to connect the Interstate Telephone Company's line with Hinkley, ten miles north of Barstow.

LOS ANGELES, CAL.—The San Gabriel River Water Committee has contributed \$200 to the forest service for the construction of a telephone line from Fellows Camp to ranger station, three miles away.

BRIDGEPORT, WASH.—Mr. Nichols of Marcus, Wash., who recently purchased the Bridgeport telephone exchange from F. G. Green has taken charge of the system personally and is anticipating improvements.

WILLOWS, CAL.—Attorney Frank Freeman, as a stockholder of the Glenn County Telephone Company, which with the Colusa County and Tehama County Telephone Companies, was sold to a subsidiary of the Pacific States Company, has commenced an action against the directors of the Glenn Telephone Company to compel them to return to the company about \$42,000 and bonds valued at \$10,000.

PORTLAND, ORE.—The Home Telephone & Telegraph Company is to be reorganized. Notice has been given the bondholders of the company that the company would be unable to meet its obligation to pay the semi-annual interest on its bond issue, due October 15th. This is to be the first step in the reorganization of the company's securities, in order to place the company on a more substantial basis. In the meantime, the company will maintain its present service and meet all current obligations.

TRANSPORTATION.

WALLA WALLA, WASH.—Granting of a franchise to the Walla Walla Railway Company for the construction and maintenance of an electric line on South Ninth street from Orchard to Main street will be submitted to the voters at the regular election this fall.

SALT LAKE, UTAH.—Joel Richards, traffic manager of the Saltair Beach Company, states that the Saltair Railroad,

will be electrified and an extension to Garfield completed this winter at a cost of more than \$300,000. A bond issue in this amount will be floated at once.

SPOKANE, WASH.—Announcement has been made that plans are being worked out by the Great Northern Railroad Company for the electrification of more than 300 miles of main line between Spokane and Seattle, and other mountain divisions in the West. It is understood the actual preliminary work on the project will be started by next summer.

DIXON, CAL.—J. J. Smith, prominent farmer and stock raiser of Solano county, and recently elected director of the Sacramento Valley Electric Railroad or the "Farmer's Line," states the company has no intention of going out of business and on the contrary is planning the building of the second unit from Dixon to Woodland. The board of directors plans to push to completion the unit of the proposed road as soon as the outstanding notes and interest thereon shall be collected.

IRRIGATION.

FILLMORE, CAL.—At a recent meeting of the city trustees a letter was received from the Fillmore Irrigation Company stating that work would soon be underway on a new pipe line on A street.

OAKDALE, CAL.—The contract for concreting the main canal of the Oakdale irrigation district at Two-mile Bar has been let to Tieslau Bros. of Oakland, on their bid of \$5.10 for concreting and \$1.50 for excavation.

DINUBA, CAL.—C. F. Balaam and C. A. Beinhorn of Exeter, and Charles H. Segerstrom, who have bought orange groves at Naranjo, as well as 40 acres lying between these groves, will install a modern irrigation system.

PHOENIX, ARIZ.—The ranchers around Higley and on the desert east of Mesa are taking active steps toward securing electric power to be used in raising water for irrigation. The plan is to organize a district to comprise 50,000 acres. It is estimated that \$5 per acre will cover the needed amount for running main lines, placing of transformers, etc.

WILLOWS, CAL.—The supervisors have fixed the boundaries of the Jacinto irrigation district on practically the lines as approved by the state engineer. A number of purchasers of land who hold contracts under the Superior California Farm Lands Company and who asked to be excluded, were denied that privilege owing to the fact that their contracts provide for an irrigation system.

NORTH YAKIMA, WASH.—The fourth annual convention of the Washington Irrigation Institute will be held in this city on November 13-14. The leading speakers will be: John A. Whitsoe, president of Utah University; I. D. O'Donnell, of Billings, Mont., United States Supervisor of Irrigation; E. A. Golderweiser, statistician of the United States Department of Agriculture, and Governor Ernest Lister.

MODESTA, CAL.—Bids for the purchase of the \$465,000 bonds voted by the Waterford irrigation district for rights to the main canal of the Modesto district, and for the construction of a distributing system of canals, have been rejected by the Waterford district directors. The board will re-advertise for bids, to be opened November 10th, in hope of getting higher bids. All offers were too low, ranging from 93¾ to 96½.

SAN BERNARDINO, CAL.—The initial step in the purchase for \$2,500,000 of the properties of the Arrowhead Reservoir & Power Company was taken when an option was signed between Victor C. Smith, vice-president and general manager of the company, and Charles F. Guthridge of Los Angeles, who, with other big owners in the region, want to organize an irrigation district project. Under this scheme lands on both sides of the Mojave River from Hesperia to Victorville would be included.

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Tools.	Cost.	List.	Sell.
16 ft. x 0 in. Extension.....	7.20	7.20	7.20
20 ft. x 0 in. Extension.....	9.00	9.00	9.00
24 ft. x 0 in. Extension.....	10.80	10.80	10.80
28 ft. x 0 in. Extension.....	14.00	14.00	14.00
1/4 x12 in. Star Drills, per doz....	8.50	8.50	8.50
3/8 x12 in. Star Drills, per doz....	8.50	8.50	8.50
1/2 x12 in. Star Drills, per doz....	10.00	10.00	10.00
5/8 x12 in. Star Drills, per doz....	12.00	12.00	12.00
3/4 x12 in. Star Drills, per doz....	14.00	14.00	14.00
7/8 x12 in. Star Drills, per doz....	16.00	16.00	16.00
1 x12 in. Star Drills, per doz....	18.00	18.00	18.00
1 1/4 x12 in. Star Drills, per doz....	24.00	24.00	24.00
1/4 in. Star Drill Points, per doz..	8.50	8.50	8.50
9/32 in. Star Drill Points, per doz.	8.50	8.50	8.50
5/16 in. Star Drill Points, per doz..	8.50	8.50	8.50
3/8 in. Star Drill Points, per doz....	8.50	8.50	8.50
3/4 in. x 6 in. Octagon Drill Holder for point	24.00	24.00	24.00
Extension Boring Machines, each	24.00	24.00	24.00
Zinc Oilers, per doz.....	25.00	25.00	25.00
Transformers—Bell.	4.00	4.00	4.00
16 Watts, Junior	3.00	3.00	3.00
25 Watts, "A"	4.00	4.00	4.00
25 Watts, "B"	5.00	5.00	5.00
60 Watts, "A" heavy output.....	6.00	6.00	6.00
60 Watts, "B" heavy output.....	7.00	7.00	7.00
8 Volts, 25 W.....	5.00	5.00	5.00
6-12-18 Volt, 60 W.....	7.50	7.50	7.50

WIRE

Rubber Covered.	Cost.	List.	Sell.
Solid Single Braid, per 1000 ft.	347.00	347.00	347.00
0	267.00	267.00	267.00
1	216.00	216.00	216.00
2	176.00	176.00	176.00
3	147.00	147.00	147.00
4	122.10	122.10	122.10
5	77.10	77.10	77.10
6	53.97	53.97	53.97
8	26.85	26.85	26.85
10	20.65	20.65	20.65
12	10.80	10.80	10.80
14	10.55	10.55	10.55
Solid Double Braid, per 1000 ft.	32.75	32.75	32.75
8.35 Amps.....	85.10	85.10	85.10
10.25 Amps.....	61.80	61.80	61.80
12.20	45.50	45.50	45.50
14.15	34.40	34.40	34.40

Lead Encased Wires.

Always get quotations from jobber.			
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The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

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Journal of Electricity, Power and Gas
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Shades.	Cost.	List.	Sell.
Flat Opal, 6 and 8 in.....	.25	.25	.25
Flat Opal, 10 in.....	.35	.35	.35
Flat Opal, 12 in.....	.75	.75	.75
Flat Opal, 14 in.....	.85	.85	.85
Flat Opal, 16 in.....	1.00	1.00	1.00
Half Shades, Billiard Type.....	1.25	1.25	1.25
Parabola Reflectors (O. B.).....	.75	.75	.75
Parabola Reflectors (Green) .....	.60	.60	.60
Flat Tin Shade, 8 in.....	.35	.35	.35
Cone Tin Shade, 8 in.....	.45	.45	.45
Cone Tin Shade, 10 in.....	.50	.50	.50
Cardboard, Plain Edge, 8 in.....	.30	.30	.30
Cardboard, 10 in.....	.40	.40	.40
Cardboard, Brass Edge, 8 in.....	.35	.35	.35
Cardboard, Brass Edge, 10 in.....	.45	.45	.45
Tape.			
Friction, per lb.....	.....	.....	.50
Rubber, per lb.....	.....	.....	1.00
White, per lb.....	.....	.....	.75
Linen, per yd.....	.....	.....	.01
Asbestos, Ribbons .....	.....	.....	1.80
Tacks.			
Carpet Tacks, .05 per box.....	.....	.10	.10
Tools.			
No. 2 Armstrong Stock, complete, each .....	.....	12.00	12.00
No. 20 Beaver Stocks, 1 in. to 2 in. No. 41 Beaver Stocks, 2 1/2 in. to 3 1/2 in. ....	.....	25.00	25.00
No. 1 Toledo Stocks.....	.....	110.00	110.00
No. 2 Toledo Stocks.....	.....	15.00	15.00
Vises, large .....	.....	25.00	25.00
Vises, large .....	.....	8.00	8.00
1/2-in. Hickeys .....	.....	20.00	20.00
3/4-in Hickeys .....	.....	1.75	1.75
3/16 in. Pipe Reamers.....	.....	2.25	2.25
7/16 in. Pipe Reamers.....	.....	1.00	1.00
1 3/16 in. Pipe Reamers.....	.....	1.25	1.25
1 in. to 6 in. Chain Tongs.....	.....	3.50	3.50
1/8-in. to 1 in. Eck Pipe Cutters..	.....	9.00	9.00
1/2-in. to 2 in. Eck Pipe Cutters..	.....	3.00	3.00
4 ft. x 0 in. Ladders—Uddell.....	.....	5.00	5.00
6 ft. x 0 in. Ladders—Uddell.....	.....	2.00	2.00
8 ft. x 0 in. Ladders—Uddell.....	.....	3.00	3.00
10 ft. x 0 in. Ladders—Uddell.....	.....	3.00	3.00
12 ft. x 0 in. Ladders—Uddell.....	.....	4.00	4.40
14 in. x 0 in. Ladders—Uddell.....	.....	5.00	5.00
16 ft. x 0 in. Ladders—Uddell.....	6.00	6.00
12 ft. x 0 in. Extension.....	7.00	7.00
.....	8.00	8.00
.....	5.40	5.40

Tacks.

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Tools.

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ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

- | | |
|--|--|
| A-1 American Ever-Ready Works of National Carbon Co
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco. |
| B-1 Baker-Joslyn Company..... 5
71 New Montgomery St., San Francisco; 911 Western
Ave., Seattle; 353 E. Second St., Los Angeles. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco. | N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San
Francisco. |
| C-1 Century Electric Co..... 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Fran-
cisco; 65 Front St., Portland, Ore. | N-3 National Lamp Works of G. E. Co.....
(All Jobbers.) |
| C-3 Crocker-Wheeler Co..... 3
87 New Montgomery St., San Francisco; 228 Central
Avenue, Los Angeles. | N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co..... 4
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Ore.; San Fernando Bldg., Los Angeles. | N-6 National Carbon Co.....
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St. No., Portland; 200-210 Twelfth St., Oakland; 575
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Rialto Bldg., San Francisco; 724 So. Spring St., Los
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Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, NOVEMBER 4, 1916

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HEAT ENERGY AND ELECTRICITY.

BY E. A. WILCOX.

A NEW INVENTION FOR MEASURING CURRENTS IN CABLES.

BY C. B. MERRICK.

TESTS OF IRRIGATION PUMPING PLANTS

BY R. H. CATES.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries

Edison Storage Battery Co.
Electric Storage Battery Co.

Boiler Feed Water Treatment

Dearborn Chemical Co.

Brushes

National Carbon Co.

Chain Drive

Morse Chain Co.

Conduit Products

Sprague Electric Co.

Expansion Bolts

Western Electric Co.

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Hemingray Glass Co.
Locke Insulator Mfg. Co.
Pierson, Roeding & Co.

Lamps

National Lamp Works.

Motors

Century Electric Co.
Wagner Electric Mfg. Co.

Piping

Pittsburg Piping & Equipment Co.

Pole Line Hardware

Baker-Joslyn Co.
Hubbard & Co.
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JOURNAL OF ELECTRICITY

POWER AND GAS



Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXVII

SAN FRANCISCO, NOVEMBER 4, 1916

NUMBER 19

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HEAT ENERGY AND ELECTRICITY

BY E. A. WILCOX.

(This article gives a brief exposition of the fundamental principles of heat transfer in general and electric heating in particular. Knowledge of the points made is necessary for every salesman of heating devices. It is taken from a comprehensive text on "Electric Heating" by the author and prefaces a number of similar abstracts which will be published in these columns from time to time in the future.—The Editor.)

Demand for Heat.—The demand for heat is greatest in temperate climates where it is essential to life, health, and comfort. Economic development has progressed more rapidly in the colder climates and has brought about numerous and important social and industrial uses of heat greatly in excess of the relative increase in population.

Advantages of Electric Heat.—This demand for heat, the great lack of efficient fuel apparatus, and the many disadvantages of fuel combustion, have opened up a large field for the utilization of electric heat. Electric energy may be transformed directly into heat energy at one hundred per cent efficiency. Its use presents no such difficult problems as are inherent in the utilization of fuel. It does not vitiate the atmosphere. It is clean, safe, and sanitary. Greater quantities and more intense heat can be produced in a given space electrically than by any other means. It produces heat directly where it is to be applied. It can be measured, and controlled both as to temperature and quantity, more readily than can any other form of heat energy. It eliminates the disadvantages of fuel storage and transportation. The losses of heat that obtain in the combustion of fuel are enormous. From an economic standpoint, our rapidly depleting natural fuel resources make the use of hydroelectric energy as a heating medium a real aid to efficient progress.

Nature of Heat.—Consideration of the nature and scientific properties of heat is necessary to a thorough understanding of this subject. It is a form of energy having two essential qualities corresponding to intensity and quantity. The intensity is measured by temperature and the quantity is measured by the British thermal unit, (i.e., heat unit, or B.t.u.)

Temperature Measurement.—The property of heat called temperature is proportional to the heat intensity, and may be measured with a thermometer or a pyrometer. The sensation of feeling heat in various bodies has reference not to the actual quantity of heat in them but to their relative temperatures.

Many types of thermometers have been developed for various temperatures and classes of work, but the Centigrade and Fahrenheit scales are applied to

most of those employed in modern practice. In the Fahrenheit thermometer the freezing point of water is taken at 32 degrees and the boiling point of water is taken at 212 degrees, the distance between these two points being divided into 180 degrees. In the Centigrade thermometers the freezing point of water is taken at 0 degrees and the boiling point at 100 degrees.

Temperature Fahrenheit = $\frac{9}{5} \times \text{temperature deg. C.} + 32 \text{ deg.}$
Temperature Centigrade = $\frac{5}{9} \times \text{temperature deg. F.} - 32 \text{ deg.}$

Measurement of Heat.—Heat cannot be measured directly by a thermometer but it may be measured by noting the amount that some standard is raised in temperature. Water has been universally adopted as the standard and heat is measured by its power to raise the temperature of a given weight of it. The standard unit for heat measurement, therefore, is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit, and is termed the British thermal unit.

Specific Heat.—The capacity for absorbing heat under changing temperatures varies greatly with different bodies. The same amount of heat that would raise one pound of water one degree, for instance, would raise about eight pounds of iron one degree in temperature. Specific heat is the term used to express this property of bodies. It may be defined as the number of B.t.u., or fraction thereof, required to raise the temperature of one pound of any substance one degree Fahrenheit.

A clear conception of the use of this unit of measurement is essential to the designer of heating apparatus, since it indicates the capacity for absorbing heat for a given temperature change. All the heat taken up in raising the temperature of a substance is given off when the body cools. The total heat absorbed by a body is equivalent to the product obtained by multiplying temperature difference, weight, and specific heat. It will be noted from the table in the back of the book that the specific heat of water (i.e., its heat absorbing power) is greater than that of most known substances.

Thermal Capacity.—The thermal capacity of a

substance is the quantity of heat required to raise its temperature one degree. It is the product of its specific heat and mass. As the specific heat of water is unity, fifteen pounds of water has a thermal capacity of $15 \times 1 = 15$ B.t.u. Likewise the specific heat of cast iron being .1298, fifteen pounds of iron has a thermal capacity of $15 \times .1298 = 1.947$ B.t.u.

The Calorie.—Heating calculations are frequently expressed in calories instead of British thermal units. The French thermal unit, or calorie, is that quantity of heat required to raise the temperature of one kilogramme of water one degree Centigrade. It is equivalent to 3.968 British thermal units; or one British thermal unit is equal to .252 calorie.

Mechanical Equivalent of Heat.—Heat and mechanical energy are mutually convertible. The number of foot-pounds of mechanical energy equivalent to one British thermal unit is the mechanical equivalent of heat. It has been established experimentally that one B.t.u. is equal to 778 foot-pounds, and on that basis it has been calculated that one horsepower is equivalent to 2545 B.t.u. per hour.

Relation to Electrical Units.—Where resistance is offered to the flow of an electric current the electric energy is converted into heat energy. The heat generated is proportional to the resistance of the conductor, the square of the current strength, and the length of time the current flows. It has been established experimentally that one ampere of current flowing through a resistance of one ohm for one hour will generate 3.412 B.t.u.. Since one ampere flowing one hour through a resistance of one ohm is equivalent to one watt-hour, 3.412 B.t.u. equals one watt-hour ($EIT = RI^2T$) or 3.412 B.t.u. equals one kilowatt hour.

If it is desired to raise a certain quantity of a substance through a certain temperature range the number of kilowatt hours required for the operation may be calculated as follows:

$$\text{Kw-hr.} = \frac{\text{Degrees rise F.} \times \text{Pounds} \times \text{Specific Heat}}{\% \text{ Efficiency} \times 3412}$$

Divide the number of kilowatt hours determined by the above calculations by the number of hours allowed for the operation and the result will be the kilowatts of heater capacity required for performing the work.

Latent Heat.—The quantity of heat which is absorbed by a body in a given state in converting it into another state without changing its temperature is termed its latent heat.

Latent heat of fusion is the heat absorbed in changing a body of a certain weight from a solid to a liquid without changing its temperature. When the operation is reversed the same quantity of heat is given off as was previously absorbed.

Latent heat of evaporation is the heat required to change a unit weight of a solid or liquid at a given temperature into a gaseous state at the same temperature. It is the heat that disappears during the change and which will reappear if the operation is reversed. Whereas it requires only 180 B.t.u. at atmospheric pressure to heat a pound of water from the freezing to the boiling point (termed sensible heat), it requires 970 B.t.u. (latent heat of evaporation) to convert the same quantity of water into steam at 212 degrees F.

The total heat of evaporation is the sum of the sensible heat and the latent heat of evaporation.

Radiation.—Heat passes from warm to cold bodies by three general methods,—radiation, conduction, and convection. Radiation of heat takes places between bodies at all distances apart and the heat rays proceed in straight lines until intercepted or absorbed by some object. The amount of heat transmitted varies inversely as the square of the distance from the source. The rate at which heat is given off or absorbed depends upon the character of the surfaces of the bodies as well as upon their relative temperatures. Dark and rough surfaces radiate and absorb heat more readily than smooth and polished ones. Radiant heat passing through air or other gases does not affect their temperature to any appreciable extent.

Conduction.—The transfer of heat between two bodies or parts of a body in direct contact with one another is termed conduction. It differs from radiant heat in that it does not necessarily travel in straight lines, and in its gradual rather than instantaneous transfer. The quantity of heat conducted is proportional to the cross sectional area, to the temperature difference, and to the character of the material.

Metals are, in general, better conductors of heat than other materials, although they vary to a very great extent. The conducting power of stone is less than one per cent that of copper, and iron is about 3500 times as good a conductor as air.

Convection.—The transfer and diffusion of heat in a fluid mass through the motion of the particles of the mass is termed the convection of heat. The particles must be in constant motion in order to insure uniform temperature of the mass. When the particles come into contact with hot bodies the mass will be warmed in proportion to the freedom of circulation in the fluid.

Air is usually heated in a room by circulation of the air particles and bringing them into contact with heated surfaces. The better the circulation of air against these surfaces the more uniform will the room temperature become.

Comparisons of Fuel and Electric Heat.—The relative heating values of fuels are often compared with electric heat. For instance, it may be shown that with coal having a heating value of 14,000 B.t.u. per pound and costing \$5 per ton, manufactured gas having a heating value of 600 B.t.u. per cu. ft. and costing \$1 per thousand cu. ft. and electricity having a heating value of 3412 B.t.u. per kilowatt hour and costing one cent per kilowatt hour, one cent will buy 56,000 B.t.u. of coal heat, 6000 B.t.u. of gas heat, and 3412 B.t.u. of electric heat. However, the fact must not be overlooked that all fuel apparatus is naturally less efficient than electric apparatus. With average efficiencies of say 10 per cent for coal, 20 per cent for gas, and 70 per cent for electric apparatus, the purchasing power of one cent under the above assumed prices and heating values would be 5600 B.t.u. of coal heat, 1200 B.t.u. of gas heat, and 2388 B.t.u. of electric heat.

The following table will be of assistance in making hasty comparisons of the B.t.u. value of fuel and electric heat. Efficiencies lower than 50 per cent are seldom, if ever, encountered in electric applications and are therefore omitted from the table.

B.t.u. Purchasing Power of One Cent.

Efficiency of Apparatus in %.....	100	75	50	30	20	10
14,000 B.t.u. Coal—						
\$ 5.00 per ton.....	56,000	42,000	28,000	16,800	11,200	5,600
\$10.00 per ton.....	28,000	21,000	14,000	8,400	5,600	2,800
600 B.t.u. Gas—						
\$1.00 M. cu. ft.....	6,000	4,500	3,000	1,800	1,200	600
\$1.50 M. cu. ft.....	4,500	3,375	2,250	1,350	900	450
Electricity—						
1c per kw.-hr.....	3,412	2,559	1,706	....	....	....
2c per kw.-hr.....	1,706	1,279	853	....	....	....
3c per kw.-hr.....	1,137	853	568	....	....	....
5c per kw.-hr.....	682	512	341	....	....	....

Actual experience proves that many careful calculations do not work out in practice. One might assume from the above figures, for instance, that the cost of using a gas range would be at least five times as great as the cost of using a coal range. We know, however, that the average cost for cooking is less with gas than with coal under the prices assumed.

Cost should not be the only consideration in determining the best method to adopt. Improvement of product, elimination of waste, increased safety, saving of labor and skill, greater comfort and cleanliness, possibility of performing new and otherwise impossible operations, are all essential economic advantages that accrue to the user of electric heat.

RESULTS OF LAST YEAR'S PROSPERITY WEEK.

Here are a few results of last year's Electrical Prosperity Week:

It was the greatest publicity campaign ever carried out.

The President of the United States endorsed it.

Big magazines issued Electrical Numbers.

Record crowds at parades; 70,000 viewed parade in one city.

Brought electricity before the public as never before.

Electrical shows held in 30 cities.

Advanced commercial spirit of the industry five years.

Brought better co-operation between central stations and dealers everywhere—and better co-operation between the public and the public utilities.

One manufacturer alone sold \$100,000 worth of goods as a direct result of the "Week."

7,649,200 pieces of E. P. W. literature were sent out.

These records will be smashed by A. E. W. 1916.

Already advertising has reached a giant stature; it is a Samson of restored and multiplied strength whose eyes have been opened to a vision of his own responsibility and power.

Among the things that appear in this vision are the amazing possibilities of advertising applied in fields at present hardly pre-empted—the service of the nation in its varied needs; the service of the church and every accepted means of moral and social improvement; the service of big business and of little business, in going direct to the people and stating their case openly as man to man.

With "Truth in Advertising" clearly and universally recognized as being as truly intelligent as it is honest, men of the widest vision may well hesitate to fix a deadline of achievement in the service of mankind beyond which this great modern force may not go!

A NEW INVENTION FOR MEASURING CURRENTS IN CABLES.

BY C. B. MERRICK.

It is an undisputed fact that the present day metering of large direct current loads is both cumbersome and expensive. This is due to the necessity of building the meters so that they will carry the full line current to be measured, or to the necessity of connecting them with heavy shunts which are inserted in the line. The shunt method is liable to include the errors due to change in resistance which may be caused by change in contact, uneven temperatures on shunt and meter, etc. In addition to the first cost of installation, the maintenance cost of these meters is high, and the periodic checking necessary for accurate results is exceedingly laborious because of the requirement that the tests be made without discontinuing service, whereas installing a standard check meter in series without a shutdown is a painstaking process.

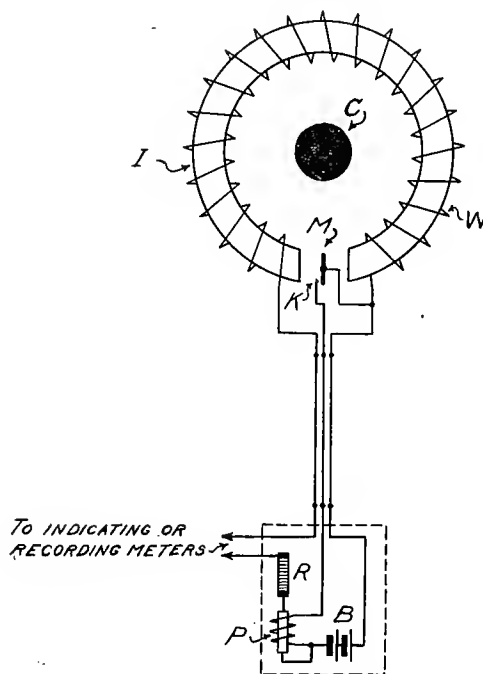


Fig. 1. Split Coil D.C. Ratio Relay.

A long step has been made in the forward progress of the electrical world by the application of split coil measurement to direct current line loads.

This method combines accuracy, flexibility, and ease of operation in measuring direct current loads without opening the circuit or in any way interfering with the service, and without the cumbersome process of installing jumpers. This is especially useful in the case of large power companies for a rapid and accurate check of the meters on the outgoing feeders at the substation, or on the meters of large consumers. It gives direct readings in amperes of the current flowing through any conductor about which the split coil of the instrument is clamped. The wide range of operation covers current values from zero to 3000 amperes, thus eliminating the necessity for more than one instrument. This flexibility, together with the fact that the current value is indicated on a direct reading scale of uniform divisions, and the rapidity with which readings can be made, form a combination that will at once recommend the meter for practical use.

Two forms have been made up, one called the direct current ratio relay, is automatic in its operation, while the other known as the direct current line testing set is manipulated by the tester. The first device consists of the split coil to be clamped about the cable or conductor, a storage battery for sending the current through the split coil and thus creating a field to neutralize the flux due to the current in the cable, and a solenoid plunger which controls and regulates the current flowing through the windings of the split coil. This split coil shown in detail in Fig. 1, consists of an iron core (I) wrapped with many turns of fine wire. A hinge on one side allows the coil to be quickly slipped about the cable (C). It is then held in position by the insertion of the plug which completes the circuit through the coil and battery, and introduces a small air gap into the magnetic circuit of the coil. In this air gap is located a thin strip of magnet steel (M) called the contactor,

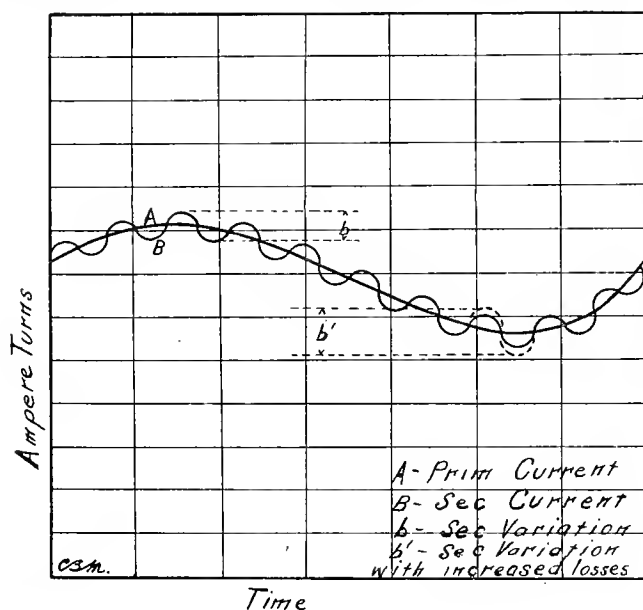


Fig. 2. Relationship of Secondary to Primary Currents.

which is affected by the magnetic fields about it. This contactor opens and closes an auxiliary circuit through the battery (B) and the windings of the solenoid (P). When the coil is placed over the cable, a magnetic flux is produced in the iron core which causes the contactor magnet to change its position so as to align itself in the magnetic field, thereby closing the auxiliary circuit at (K) and energizing the solenoid. The solenoid in turn acts upon the plunger and compresses the carbon disks (R) lowering the resistance in the secondary circuit and increasing the flow of current through the turns (W) of the split coil. The resulting flux due to this current in the secondary, tending to neutralize the flux produced by the primary line current, continues to increase, until it reaches a value such that the magnet contactor opens the auxiliary circuit, and relieves the pressure on the carbon disks by allowing the plunger to drop away. A consequent reduction of the secondary current takes place, and the primary flux again forces the contactor over to close the auxiliary circuit and increase the secondary current. This cycle is repeated automatically as long as the current flows through the primary cable, and the value of this current is found by taking the average of the readings of the ammeter.

Since the flux through the coil due to the winding (W) is dependent only upon the current value through this circuit, and in no way upon the voltage, an increase or decrease in the external resistance has no effect what-

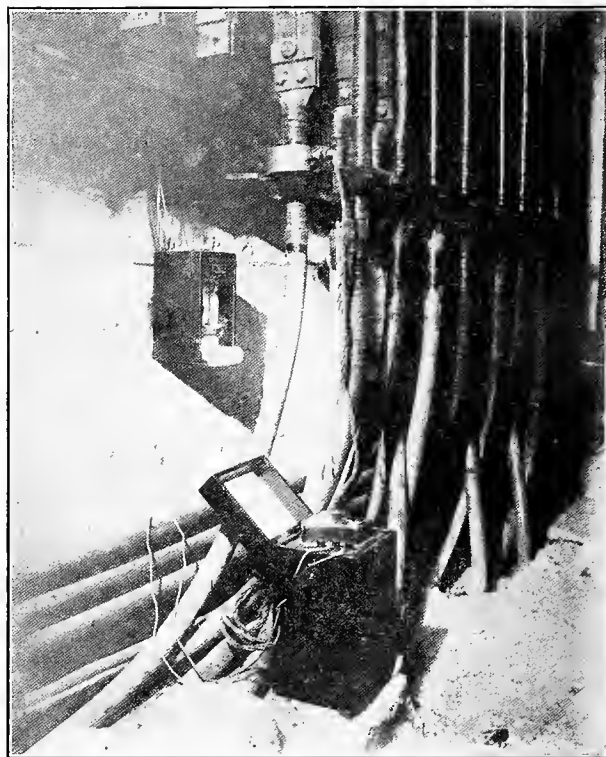


Fig. 3. Ratio Relay Coil, shown Strapped About Cable for Determining Current Flow.

ever upon the accuracy of the readings. This is true since the magnet contactor remains in position keeping the contact (K) closed until the ampere turns of the secondary and the consequent flux through the coil is equal to the ampere turns of and the flux produced by the line current, plus the very small losses of the instrument. The advantage of this condition is apparent, in that poor contacts in the circuit cannot produce an incorrect reading. Also an indicating meter only, or a recording meter only, or the two in series may be connected for checking one against the other.

The second form of the meter consists of the split coil and magnet contactor, the battery and meter and a small compression carbon or rheostat in the secondary, in series with the battery, meter and split coil windings. The rheostat is adjusted by the operator so that the primary and secondary flux alternately influence the contactor to flip from one side to the other, showing that the secondary ampere turns are either greater or less than the primary. This hand regulation replaces the automatic operation of Fig. 1.

The hand controlled meter is more compact and is proportionately more portable for line testing work. The automatic meter eliminates the personal equation of the operator and permits of the installation of the recording meter, thus giving a continuous record of the load throughout any period of time.

The principle of operation of the ratio relay is nearly identical with that of the a.c. current transformer. In the latter the current through the primary produces a flux in the iron core which in turn produces a current in the secondary, the size of this current being

such that the ampere turns of the primary and the secondary are the same, except for the slight losses due to hysteresis and eddy currents in the core, and small copper losses. These losses can be partially compensated for by making the secondary turns slightly less than the theoretical number necessary for the given ratio of transformation.

In the ratio relay the same principle is involved, but the secondary current is supplied by an auxiliary source, and not by induction. Since the flux due to the secondary current fluctuates regularly, so that the magnet contactor is affected alternately by the primary and secondary flux, the ratio of transformation is exactly equal to the ratio of secondary and primary turns. An increase in the core losses of the direct current split coil does not mean an inaccurate reading on the meter, but simply a wider range of fluctuation of the secondary current, the average remaining the same as before at the correct value. Fig. 2 shows the relation of the secondary to the primary currents. Thus it will be seen that the inherent regulation of the ratio relay is better than that of the a.c. current transformer which is so widely and satisfactorily used.

Exhaustive tests upon the ratio of transformation by the two watt-hour-meter method have demonstrated that its accuracy is well within the limits of mechanical accuracy. In this method two watt-hour-meters are connected in series and adjusted to give equal readings. One is then connected in the primary and the other in the secondary circuit of the ratio relay, a primary being provided for the core consisting of a coil of as many turns as the secondary making the ratio 1 to 1, the relative registration then showing the ratio of operation of the split coil. In this way it has been determined that the error of the apparatus is only a small fraction of one per cent. Consequently the meter is admirably adapted for precision measurements of large d.c. loads. The field of precision measurements on small d.c. loads is open for the relay by the simple process of looping the conductor through the coil until the ampere turns are sufficient to give a reading on the meter, and dividing this reading by the number of turns about the coil, which gives the line amperage.

In testing three wire meters the old method of installing a shunt in each side of the line required simultaneous readings. The ratio relay combines the two readings automatically, provided both sides of the line are run through the coil, just as both legs would be run through a current transformer, thus making it practicable for one man to make the tests instead of two as before. In this way also it is possible to combine any two circuits so as to give one reading on the meter.

The apparatus is particularly well adapted for use in electrolysis work, since the current flowing through any pipe, conduit or cable can be ascertained by slipping the coil about the conductor. In this work it would be impossible to open the conductor for the insertion of an ammeter, and the calculation of the current by voltage drop is unreliable, due to variations in resistance, or the resistance being unknown. Therefore the ratio relay fills a long felt need by providing a speedy and reliable means of ascertaining the current flow in electrolysis investigations. The presence of iron in the vicinity of the coil has no effect upon the working of

the apparatus. This is advantageous because a cable enclosed in an iron pipe can be tested for electrolysis currents or load as well as any other.

The simple operation of the instrument is illustrated in Fig. 3, which shows the meter in actual operation on one of the outgoing feeders of a large direct current station.

The instrument is the invention of Mr. Otto A. Knopp of the engineering department of the Pacific Gas & Electric Company.

A SQUARE DEAL TO UTILITY COMPANIES.

The Portland Oregonian in its chief editorial of October 18th had the following to say concerning the city's attitude in local street railway problems:

"It ought not to be necessary to say one word in support of the representations of Mr. C. M. Clark of the Portland Railway, Light & Power Company. They reflect the the most elementary justice imaginable. The enterprise which he represents has made its investments in Portland on a contractual basis. It has agreed in return for certain privileges to provide certain service for the public, to pay certain taxes, to do certain paving, to submit to certain other exactions upon its revenues.

"Now appears another transportation service which assumes a heaven-born right to all the privileges granted the street railway company, in return for which it gives less adequate service and submits to no extraordinary exactions. It becomes an active competitor of the regulated service; it operates only on profitable routes; it seizes the streets which, through the sole exertion of the street railway company, have become the popular revenues of travel; its service is intermittent; it possesses no financial responsibility which may be called upon to compensate for injuries committed by it; it produces nothing; it surrenders nothing to the public; it is merely with ungracious tolerance permitted to take a part of that which the city has in spirit or by implication already granted to the street railway company and for which the city is being paid in hard cash.

"Let it be emphasized: The city of Portland has actually bartered and sold to the Portland Railway, Light & Power Company a certain thing of value. Yet it presents as a free gift to others, not a similar thing, not a corresponding thing, but the same thing that it has already sold and for which it is receiving regular payment. For the jitney builds up no traffic of its own. It does not pioneer in new districts. It does not traverse streets not already served with transportation. It goes into the field already occupied and grabs the best in sight.

"The failure of Portland to regulate the jitneys—to tax them on the same basis as the street railway is taxed, to require them to bear a portion of paving costs as does the street railway, to collect from them a bridge toll, to compel them to give transfers, to give service where service is needed, to insist that they be bonded for protection of their patrons—this failure has been termed an exhibition of bad faith, as one of unfairness toward invested capital. It is worse. It is downright dishonesty."

This instrument set up for operation, is shown in Fig. 2. The discharge pipe is drilled and tapped at the

proper point for three-quarter inch plug, the inside diameter of the pipe being carefully measured before inserting the flow meter plug.

The particular instrument used in our work is designed in such a way that the U tube containing the mercury may be tilted and operated at an angle which will give about $2\frac{1}{2}$ times the reading obtainable with the tube in a vertical position. The instrument is calibrated for use at this angle.

As the majority of the plants discharge at a low velocity, this feature makes it much more accurate than some of the type in general use which read only in a vertical position. Our engineers have checked this instrument carefully with weirs, and by checking with the contents of steel and concrete tanks, find it reliable when a reasonable velocity of discharge is obtainable. In cases where the discharge velocity is extremely low, the discharge pipe is carried to a portable weir.

The electric meter department makes routine tests of all power meters in the various districts from time to time, and as induction motors are used on all pumping plants, the power input is ordinarily obtained by timing the revolutions on the disk of the meter used at the plants. In special tests portable poly-phase test meters are used.

The lift is obtained in various ways, depending on the character of the installation.

As the pump manufacturer uses his own judgment as to size of suction and discharge pipes to the surface of the ground, it is not customary to make any allowance for friction in the system from the water level to this point. Where water is discharged at a higher level, calibrated pressure gages are used at the surface and the measured lift from the water level to the gage is added to complete the total lift, unless otherwise specified in the manufacturers' guarantee. An electric sounder has been developed to obtain the lift from the pumping level to the surface where deep well turbines are installed in well casings.

As the space between the turbine column and the well casing is limited, it is necessary to use a very small sounder, and as the surface of the water in this casing is often covered with several inches of oil from the lubricating system, the sounder must be operative after its point has passed through this oil. The sounder used by our department is constructed as follows:

A hard wood box having one compartment containing a 25,000 ohm Holtzer Cabot magneto and another containing about four hundred feet of No. 22 pothead wire on a spool is used, the inner end of the wire being attached to a shaft running through the center of the spool and resting in metal bearings on each side. One side bearing has a screw contact and a wire attached to one terminal of the magneto. A crank is attached to the shaft for the purpose of winding up the wire after it has been reeled off. The other terminal of the magneto is connected to the pump frame or discharge pipe by a short piece of wire. The sounder proper is attached to the outside end of the wire on the spool. The point of the sounder consists of a solid fibre rod, one-quarter inch in diameter and three inches long, through which a small hole is drilled and a No. 18 insulated copper wire about one foot long with about one-half inch of the insulation stripped from the end, is pushed into the fibre tip to a point about one inch from the lower end

and a small hole is drilled through the side of the fibre tip opposite the bare end of the wire to prevent trapping air when the tip strikes the water. A piece of one-eighth inch lead pipe is pushed over the entire length of the No. 18 wire until it reaches the fibre tip, forming a fairly flexible section about one foot long and of sufficient weight to carry it down the well, this end piece being attached to the No. 22 pothead wire, and the joint covered with rubber tape first, then with friction tape. This sounder can be passed through a three-eighths inch hole drilled in the base of the turbine head, its contact with the surface of the water closing the circuit through the magneto and ringing the bell.

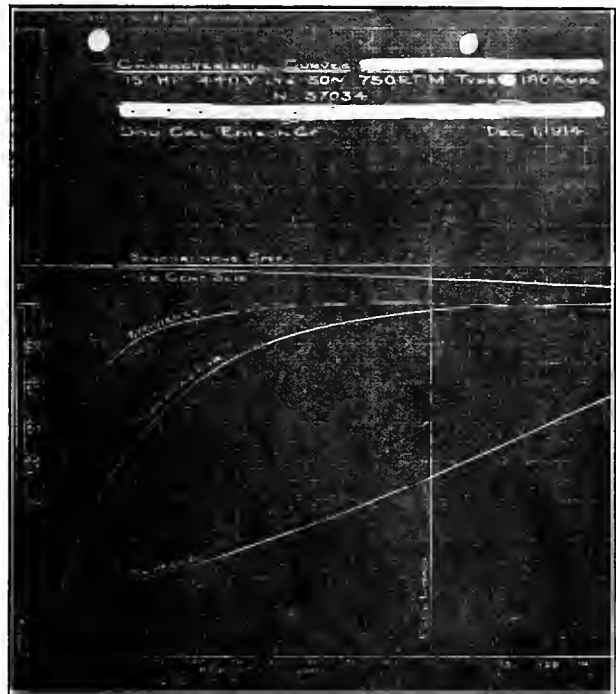


Fig. 4. Characteristic Curves of 150 h.p. Plant.

After lowering this sounder to the water level, it is withdrawn and the length measured with a steel tape.

In some cases air lines are placed in the well for the purpose of determining the pumping level. In this case a measured length of $\frac{1}{4}$ in. pipe is lowered into the well at the time the turbine is installed. This line runs to some known distance below the pump suction so that there is always several feet of water in the lower end while pumping. The upper end is fitted with a pressure gage below which is placed an ordinary auto tire valve. Air is pumped through this valve until the pressure gage reads a maximum value, which reading determines the level of the water in the well casings. This reading is taken before starting the plant and after operating long enough to obtain constant results. These readings give the draw down due to pumping.

From the discharge, power input, and measured lift, thus obtained, the overall efficiency is calculated. This represents the power consumption for which the consumer pays.

In order to make more definite comparisons of the efficiencies of the pumps alone, the overall efficiency is divided by the efficiency of the motor and the estimated efficiency of transmission where pumps are not direct connected to motors. Vertical pumps and belt connections are used in the majority of installations in this ter-

ritory as the variation in pumping levels changes during the season, making speed changes very necessary from time to time.

The efficiencies of motors vary with the size and to some extent with voltage, but from general tests we find them to be about as follows:

10 to 15 h.p.	86 %	75 to 100 h.p.	90 %
15 to 25 h.p.	88 %	Over 100 h.p.	91.5%
50 to 75 h.p.	89 %		

These efficiencies are for 220 volt and 440 volt motors. The 2200 volt motor efficiencies are from one to two per cent lower than given above.

A belt loss of six per cent is used in all cases except where the belt is evidently worn or otherwise inefficient.

The water pumped is expressed in terms of miners' inches, as this is the unit in general use in this section. This is based on one-fiftieth of a second foot, or to nine gallons per minute.

In order to enable the consumer to express his power cost in terms of water secured, the miners' inches per kilowatts input is computed, also the kilowatts per miners' inch twenty-four hours, the latter enabling him to apply his power rate and obtain the cost per inch hour which is the usual basis for selling water in this territory.

The above methods are considered to give a resulting average accuracy in overall efficiency obtained within a few per cent in individual tests, the uncertainty as to efficiency of motor and belt reducing the accuracy somewhat.

In special cases where it is necessary to obtain more accurate results, the motor characteristics are obtained from certified copies of factory tests, or tests are made at the plant. In the latter case locked rotor readings are taken at various voltages, and a Specht circle diagram is drawn. From this diagram curves are plotted showing the motor characteristics. A circle diagram together with characteristic curves taken on a 150 h.p. plant is shown in Fig. 3 and Fig. 4.

The purpose of this department is to see that the consumer at all times gets the greatest possible, water per kilowatt input, and it often happens that in certain sections of our territory, the available supply from a well varies during some portion of the pumping season, so the slowing of a pump down below its efficient capacity, and losing ten per cent in pump efficiency will decrease the pumping level 15 to 20 per cent, making the cost per inch hour less than with the original pump efficiency. For this reason, belted plants are desirable where water requirements vary throughout the pumping season.

No record of the cost per test on irrigation plants has been compiled, as the company also gives its consumers the advantage of engineering service in all kinds of industrial plants, and this feature has been no small factor in building up the large power load carried on their system.

The application of electric drive to irrigation plants enables the ranch owner to devote his entire time to his crops and other business pursuits, gives him the most value for his money, adds to his peace of mind, and I believe that the increased volume of business taken

on in this field is a glowing testimonial that he appreciates the fact that electric power for pumping purposes is the ideal installation.

TEN COMMANDMENTS FOR IMPROVING PUBLIC RELATIONS.

One of the features of a recent convention of traction managers of the Doherty organization was the suggestion of ten commandments to be observed by corporation men in their dealings with the public. This suggestion was made by Frank R. Coates and the commandments were as follows:

"A kind word quietly spoken will make friends.
"Take the public into your confidence. Lay all cards face up on the table.

"Give service that is everything that the word implies.

"Treat your employees and the public as you would be treated. Apply the Golden Rule in business.

"Remember we are all human and likely to err. Be patient.

"Keep your property maintained as nearly as possible to the 100 per cent standard.

"Officials should become connected with civic uplift bodies. Be an active member. Do your share of the work. Don't hesitate to let the public know you. Be one of them.

"Corporation offices should be devoid of red tape, and the doors should be open to the public.

"Don't keep callers waiting too long.

"Keep promises. Don't make any that you can't keep."

BETTER USE MUST BE MADE OF OIL PRODUCTION.

Although the production of crude petroleum in California still continues to reach record breaking proportions, nevertheless it is doubtful if fuel oil will ever return again to the prices prevalent in the period prior to the breaking out of the international war. This increased price is already having a marked effect in the West by turning the thoughts of central station managers once again to hydroelectric development in preference to steam turbine units.

In a recent address delivered by Van H. Manning, Director of the Bureau of Mines before the Retail Merchants' Association, the critical situation of gasoline, its price and purity was thus summarized:

The Bureau of Mines is in entire sympathy with your campaign for purity in gasoline, and wishes to be of aid, not only to all of you, but to the entire country in this important matter.

We are today facing a serious condition in the petroleum industry. We have probably reached the summit of our crude oil production in this country. According to the United States Geological Survey, our future supply of petroleum is only sufficient to last us from twenty-seven to thirty years at the present rate of consumption. This does not take into consideration any increasing demand as the years go by. In order to supply the fuel for the future automobiles, it will be necessary to make better use of our crude oil production in the future than we have in the past.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

As recently as 1897 exclusive rights to develop power from Niagara at a dollar a horsepower year rental were going begging.

* * *

A department of logging engineering has been introduced at the Oregon Agricultural College in an effort to dignify, standardize and help bring recognition to the logging industry of the West.

* * *

It is said that there are about one hundred and twenty engineering schools in America. This number seems large until expressed as a ratio to the population or one engineering school to eight hundred thousand people.

* * *

Recent investigations show that an electro-deposit of zinc on steel or iron is the only one that will withstand atmospheric conditions for any length of time. Although nickel-plated iron is satisfactory for use indoors, when exposed to the weather it almost invariably rusts.

* * *

An executive decree in Honduras regulates the distribution of water and electric light and power in the municipalities of that country. These services are under the direction of the Department of Fomento, which publishes the regulations in a recent number of its Boletin.

* * *

An interesting comparison has been made of the performance of the present type steamer and the modern Diesel driven vessel. A saving in fuel amounting to nearly twenty thousand dollars was made without considering the saving in cargo and crew under the Diesel operated boat.

* * *

The waste of water used by cities is becoming appalling. Chicago alone, according to the report of its Commission of Public Works, should easily reduce its operating expense for water supply by seven hundred thousands per year. That city now consumes 236 gallons per capita per day.

* * *

Still another export record has been broken. The total value of goods shipped out of this country in September was over half a billion dollars, or three million more than the high water mark established in August. For the twelve month period exports have passed the five billion mark.

* * *

There has been a phenomenal demand for copper again in the last few weeks, chiefly in connection with the constant requirements of belligerent countries on the allies' side, and this has obviously done much to accelerate a further upward movement in prices for all kinds of material, whether of copper itself or allied products.

* * *

Absolute proof is established that Mars is inhabited. So said Dr. Percival Lowell, the noted founder

of the Lowell Observatory at Flagstaff, Arizona, in a recent lecture in Berkeley, California. The so-called canals observed on Mars are geometric to a degree and are uniform throughout. Their length is measured in hundreds and thousands of miles. How insignificant would our far-famed irrigation and reclamation projects appear beside such monsters as these.

* * *

During the past 12 years the annual expenditures on the rural roads and bridges in the United States have increased from about \$80,000,000 to about \$282,000,000, or an increase of more than 250 per cent. During this same period the annual expenditures from state funds for road and bridge construction and maintenance have increased from \$2,550,000 to \$53,492,000, or almost 2000 per cent.

* * *

The marvelous lighting effects obtained at the Panama-Pacific Exposition have during the past year awakened a new international interest in illumination. The flood lighting of countless public buildings, new creations for street lighting systems, and the wonder of a night spectacle of Niagara Falls, combined with countless other accomplishments are easily traceable to this origin.

* * *

Even far-off Siam is feeling the world-wide campaign of "do it electrically." Recently His Majesty the King honored the Siam Electricity Company with his presence on the occasion of the opening of the new office building of the company. His majesty, amid other ostentatious ceremonies, was graciously pleased to sign his name in the visitors' book and later retired amid a volley of twenty-one fire rockets.

* * *

A recent issue of the General Electric Review thus concludes a discussion of the beneficent results that are being brought about by the electrification of the Rocky Mountain Division of the Chicago, Milwaukee & Puget Sound Railroad: "It requires no great stretch of the imagination to visualize the day when a continuous network of transmission lines will parallel the main railroads from the Eastern Rockies to the Pacific Coast, conserving water power by using it and benefiting the general public by lower rates, increased comfort in traveling, and an almost universal distribution of energy at less cost from 'white coal.'"

* * *

Engineers and others searching out opportunities in South America continue to pass southward. On the other hand, increasing numbers of persons bound from Argentina, notably Buenos Aires, for the United States are making the voyage by way of the canal. They go to Valparaiso by way of the Transandean Railway and embark there for the Canal Zone on one of the two lines plying between Chile and the Atlantic terminus of the canal. The voyage to Balboa takes about fifteen days, and close connections are usually made on the Isthmus with ships for the United States, which are at sea from five to eight days.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Almost over night electrical applications both in the home and in the industries have grown to fabulous proportions.

Electric Heat in the Home and in the Industries

Aside from the countless electric motor applications that have found their way into the home and into the industries, electric heating devices present a new and profitable phase of development.

Are you yourself doing everything in your power to aid in still further broadening the uses of electricity? Are you as a matter of fact familiar with the countless devices that are now put on the market by reputable firms for "doing it electrically?" If you are not already familiar with these devices read the following lines and become acquainted with them by name at least and at your earliest convenience find out for yourself how they are now revolutionizing the "old way" by substituting for it the modern Aladdin or method electrical.

The lamp socket originally designed and installed in the home for lighting purposes now finds extended uses for electric irons, stoves, chafing dishes, coffee percolators, tea samovars, tea kettles, table cooking outfits, electric grills, food warmers, plate warmers and hot closets, bake ovens, nursery milk warmers, curling iron heaters, warming pads, immersion heaters and other household devices. And in addition to these are also to be found in rapidly increasing quantities the electric range, household water heater and the electric heater for buildings.

Again, in the industries electricity is playing a most important role. Electric furnaces and low temperature ovens make the production and refining of metals and countless other applications a new and more efficient art. Electric welding and the operation of electric steam boilers are also finding increasing usefulness.

And then there is almost a countless list of general applications among the more important of which may be mentioned electrical incubating and brooding of chickens, automobile heaters, bacteriological incubators, bath cabinets, beer vat dryers, branding irons, button die heaters, can capping outfits, candy batch warmers, corn-popping machines, dryers of all kinds, embossing press heaters, engravers' stones, flask heaters, gilding wheel heaters, glove stretchers, glue pots, hatters' tools, heating units, hot plates, irons, linotype pots, liquid heaters, meat branders, metal melting devices, oil tempering baths, pallette die heaters, paper seal moisteners, paper warmers, peanut roasters, perforators, pipe thawers, pitch kettles, electrical shoe machinery, solder pots and irons, sterilizers, tire vulcanizers, water stills, weight reducers and yarn conditioners.

With this issue of the Journal is to be found the introductory article to a series that will appear in its columns from time to time on the all important subject of electric heating. The articles will cover the essential features of practically the complete range of electrical heat applications, some of which have been listed above.

No central station management or sales department should allow itself to go unposted on the rapid

rise in theory and practice of devices that operate electrically.

It is to be hoped that this broad campaign of educational enlightenment on the part of the Journal, looking to a deeper, fuller co-operative movement on the part of all interested in "doing it electrically," will still further result in placing the West without a peer among those who recognize the method electrical to be the best, the biggest and the last great effort of human evolution in its fight to economically minimize the burdens of the race.

As a means of solving the tax problems of Oregon and California the voters of those states are being asked to pass upon single tax measures at the polls next Tuesday. In Oregon, under the name of the "land rent tax amendment,"

and in California as the "land tax amendment" are two initiative measures whose intent is to authorize the taking for public use of the rental and site values of land. It is proposed that practically all the tax burden be carried by realty.

Upon superficial examination this plan appears to have much to commend it. Single tax, as prominently indorsed by Henry George and his followers is a beautiful theory. Its advocates are idealists sincerely trying to remedy some of the defects of the present system. It is based upon the premise that land values are created by society and that society should consequently reap the benefits. "The Lord giveth and the landlord taketh away." They hold that private ownership of land is wrong and should be penalized by the confiscation of all rents.

Yet, subjected to searching analysis, the premise will be found fallacious. Aboriginally all property was owned jointly by a tribe. But as men became more civilized they gradually recognized the necessity for individual possession in order to obviate constant bickering and to provide proper incentive to human endeavor. It is an underlying rule of human nature that men will not work to produce wealth unless they are given security to enjoy the fruits of their efforts. In those countries where government officials have power to seize any man's property the mass of the people are miserably poor, while wherever property rights are secure wealth is abundant. To abolish private property is to reverse the whole trend of human progress,—to turn back the hands of the clock. It is a general rule that the prosperity of a people increases in direct proportion to the security of possession and enjoyment accorded the individual. The confiscation of land values proposed by the single-taxes would not only ruin every large land owner but would destroy the security upon which savings banks and other investors are largely dependent.

Aside from the economic objection to single tax there is the fiscal one of its unsatisfactoriness as a basis for taxation. The pecuniary needs of a government fluctuate rapidly. Rents do not. In practice single tax would undoubtedly create a surplus one year and a deficit the following year.

The worst feature of the proposal, however, is the moral one. Single taxers boldly propose that the state

repudiate its contracts for the sale of lands to individuals who paid their money in good faith and who are dependent upon the state guaranty of title. The state should set the example for its citizens. Such a wholesale repudiation of obligations cannot but have a pernicious effect on the people.

In addition to these economic, fiscal and moral objections there is also to be considered the matter of equity. It is manifestly unfair to penalize the unearned increment without some form of reward for decrement in value. As much money is lost by holding land as is gained. It is only the assured security of land investment that compensates for the loss that accrues as compared with any other compounded investment.

To obviate the chance of these injustices it becomes the duty of every fair-minded man to explain the error of the single tax to his neighbor and to cast his vote against it at Tuesday's election. Otherwise the commonwealth will retrograde, the citizens become shiftless and thrift a byword.

The demands for continuity of service have made the accurate measurement of current flow in cables a matter of extreme difficulty. Indeed it may be well said that the methods that have been evolved until very recently have proved expensive and cumbersome. To insert the meter in series with the cable involves a shut down or much painstaking labor. On the other hand to operate the meter as a shunt has proved unreliable and has necessitated frequent standardization.

On another page of this issue will be found an account of a recent invention of an employee in the operating department of one of the Western central stations that embodies a new and accurate method for quickly ascertaining current flow in cables.

Briefly put the apparatus consists of a coil that may be quickly fastened about the cable in which the current flow is to be measured. Through the core of this coil a definite flux will pass that is being maintained by the current in the cable. An ingenious device is next provided whereby an equal and opposite flux may be created from an auxiliary storage battery. By neutralizing this flux the current flow in the cable is then easily ascertained.

While the ingenious principle involved is entirely new the meter as a whole bears a striking similarity to the a.c. current transformer and as a consequence it has a wide availability for checking meters on large loads, for checking three wire meters with one tester, for two conductor tests and for tests where electrolysis is involved.

The flexibility and ease of operation, including simplicity of setting up, rapidity of readings and the possibility of installing the meter at some distance from the line to be tested are also commendable features.

And finally the apparatus is especially fitted for precision measurements on large or medium scale. This may indeed be extended to small readings by looping the conductor about the coil.

The underlying principle means accurate results and this has been fully substantiated by tests.

Measurement of Currents in Cables

PERSONALS

E. C. Kierstad of Milner, Idaho, has been appointed Statesman of the Jovian Order.

H. C. Jacobs of the Jacobs Electric Company has returned to Santa Rosa, Cal., from San Francisco.

H. J. Verfurth of the Central California Electric Company of Lindsay was a recent visitor at San Francisco.

F. G. Beck, assistant manager of the Ever Ready Company of San Francisco, has returned from an extended trip throughout the East.

W. I. Otis and **L. E. Sperry**, manufacturers' agents at San Francisco, recently returned from a two weeks' business trip to Los Angeles.

Otto B. Goldman has been appointed assistant professor of mechanical engineering at the Oregon Agricultural College, Corvallis, Oregon.

A. S. Moody, northwest manager of the Pacific States Electric Company, has been appointed Statesman of the Jovian Order for Oregon.

Jos. S. Thompson, president of the Pacific Electric Manufacturing Company, has returned from a ten days' trip throughout the Northwest.

Jas. B. Blair of the treasury department of the Westinghouse Electric & Manufacturing Company of Los Angeles, was a recent visitor at San Francisco.

Carl Uhden, chief engineer for the Washington Water Power Company of Spokane, has been appointed Statesman of the Jovian Order for Washington.

R. L. Cardiff, manager of the Coast Counties Gas & Electric Company of Santa Cruz, spent a few days in the latter part of the week at San Francisco.

R. L. Eltringham, electrical engineer for the Industrial Accident Commission, will make a tour of inspection of the southern part of California next week.

Thomas M. Stattler, formerly connected with the Pacific States Electric Company, has recently joined the sales force of the Thomas Day Company of San Francisco.

J. C. Kirkpatrick, president of National Pole Company of Escanaba, Mich., was a recent visitor at San Francisco, and has left for Los Angeles, where he will stop for a few days before returning East.

G. R. G. Conway, formerly chief engineer and assistant general manager, and now consulting engineer for the British Columbia Electric Railway, Vancouver, B. C., has left for Mexico City, to represent the bondholders' committees of the Mexican Light & Power Company and the Mexico Tramways.

Murray Orrick, manager of sales for the Western Electric Company, has been elected Statesman of the Jovian Order for California. **H. N. Sessions** of the Southern California Edison Company, has been appointed First Tribune for Los Angeles, and **R. E. Fisher** of the Pacific Gas & Electric Company, First Tribune for San Francisco.

E. A. Wilcox, for several years commercial agent for the Great Shoshone & Twin Falls Water Power Company at Twin Falls, Idaho, and recently electric heating specialist for the Great Western Power Company at San Francisco has been appointed manager of the Tulsa (Okla.) properties of the Public Service Company of Oklahoma.

Chas. T. Hutchinson was elected president of the Engineers' Club of San Francisco at the annual meeting on October 27th. **W. W. Shockley** first vice-president, **B. P. Legare** second vice-president, **A. H. Griswold** treasurer, and **C. E. Grunsky, Jr.**, secretary. The new directors are: **C. H. Snyder**, **A. E. Chandler** three years, **H. W. Crozier** two years, and **E. O. Shreve** one year.

F. C. Green was elected president of the Oregon Association of Electrical Contractors and Dealers at their annual meeting on October 11th; **E. W. Pierce**, vice-president and chairman of the finance committee; **R. G. Littler**, vice-president and chairman of the legislative committee; **S. C. Jaggar**, vice-president and chairman of the program committee, and **J. R. Tomlinson**, vice-president and chairman of the committee on relations with jobbers' associations.

MEETING NOTICES.

Los Angeles Section, A. S. M. E.

On Thursday, November 2, 1916, the American Society of Mechanical Engineers, Los Angeles Section, will hold a technical session at Christopher's, 741 S. Broadway, at 6 p. m. After the dinner **E. T. Sederholm**, formerly of the Nordberg Engineering Company, will deliver a paper on "Deep Mine Hoisting." The engineers of Los Angeles meet every Thursday for a 12 o'clock lunch at the roof garden of the Broadway Department Store. **Ford W. Harris** is secretary of the Los Angeles Section, American Society Mechanical Engineers.

Western Conference Board.

The delegates appointed by the various Pacific Coast Electrical Contractors' Associations to the board convened at San Francisco Oct. 26th, and formed permanent organization. Those present were: **J. R. Tomlinson** of the Oregon Association; **G. E. Arbogast** Southern California Association; **H. C. Reid**, California Association of Electrical Contractors and Dealers, and **H. C. Rohrbach** of Washington Association. **Mr. H. C. Reid** was elected chairman and **Mr. Tomlinson** secretary-treasurer. Among various subjects considered and receiving favorable recommendation to the various state associations was the universal adoption of the use of "Trade Acceptances."

San Francisco Electrical Development and Jovian League.

As evidence of its influence in educating the public at large, as well as its members, the league at its October 25th meeting, made arrangements for speakers to address various schools and associations on electrical subjects. This constructive evidence should add greatly to the value of the league. **Mr. S. V. Walton**, as originator of the plan, was appointed chairman of the committee having this duty in charge. President **Newbert** received enthusiastic reports from the other committees having charge of the league's various activities, and all signs point to a most successful administration. **H. V. Carter**, as chairman of the day, introduced the Reverend **Paul Smith**, who gave an inspiring address on "Two Great Discoveries." His speech sparkled with epigrams and aphorisms, and was heartily applauded. His argument was based upon the brotherhood of men and the conservation of human values. He showed the application of these principles in solving the problems of capital and labor, the liquor question and inter-racial differences. He characterized the new era as one of service and not of exploitation, and urged the recognition of human values rather than property values.

Los Angeles Jovian Electric League.

H. E. Sherman, Jr., Southern California representative of the H. B. Squires Company, was chairman of the day at the luncheon held at Jahnke's Tavern, on October 25th. The guest of honor was **Mrs. Estelle Lawton Lindsay**, a member of the Los Angeles City Council. Her subject, "The New Friendship Between Men and Women," was unique, and it is needless to say, interesting. It dealt with an important question of the hour, "the suffrage movement," and explained a new friendship, which **Mrs. Lindsay** claims as her own discovery—a mutual understanding and co-operation, eventually eliminating the sex antagonism, which, she says, has been due largely to the vices of men and ignorance of women. **Mrs. Lindsay** is a brilliant speaker with a keen insight into human nature, and her talk served to correct many wrong

impressions in the minds of her hearers, and to place the much-discussed subject in a new and more favorable light, as was indicated by the prolonged applause which marked the close of her speech.

Former President Holland leaves shortly for San Francisco to accept a position with the Great Western Power Company, and President Morphy, voicing the sentiment of the league, expressed sincere regret on behalf of the league, and thanked him for the loyalty and devotion displayed during his term of office.

San Francisco A. I. E. E. and A. S. M. E. Sections.

At a joint meeting on the evening of October 27th, A. H. Babcock gave full explanation of the manner in which engineers can qualify for the Officers' Reserve Corps of the United States Army, and W. J. Davis, Jr., gave a lecture, illustrated by lantern slides, of the use of steam turbines and reduction gears for marine propulsion. After telling briefly of the turbine equipment of colliers, Mr. Davis discussed their use in battleships and cruisers, giving especial prominence to the equipment of the California, now building at the Mare Island Navy Yard. The California will be one of the wonders of the American navy. Not only will her propulsion be electric, but the same power will perform all services aboard, will fire the guns, place ammunition, hoist and lower boats, raise anchors, steer the vessel, operate ventilating blowers and do the work of the kitchen, even to peeling potatoes, grinding meat, freezing ice cream and washing dishes. Steam turbines of 28,000 h.p., burning oil fuel, will generate electricity. Each of the four screws will be driven at 175 r.p.m. by a 6700 h.p. induction motor. Steam will be supplied at 280 lb. boiler pressure to two 11,000 kw. turbo-generators. At a speed of 21 knots 26,100 h.p. will be required with a water rate of 11.4 lb. per b.h.p., at 15 knots, 8500 b.h.p. at 11.6 and at 13 knots 5700 b.h.p. at 11.65 lb. per b.h.p. Full details were also given regarding turbine propulsion of cargo ships. In subsequent discussion G. W. Dickie reviewed the history of the former equipment of vessels, stating that the present vogue in steam turbine was partly due to the inability of the manufacturers of reciprocating engines to make delivery. A. H. Babcock emphasized the coming importance of Diesel engine drive.

Portland Sections A. I. E. E. and N. E. L. A.

The first biweekly luncheon of the A. I. E. E., N. E. L. A. and the Oregon Society of Engineers was held in the Oregon Hotel, Portland, Ore., Wednesday noon, October 25, 1916. The luncheon was in charge of the Northwestern Electric Company. L. T. Merwin introduced W. E. Connor, acting chairman, who in turn introduced A. L. Mills, president of the First National Bank. Mr. Mills spoke in a general way upon the financial condition and future outlook of the Pacific Northwest, and stated that he knew conditions were better today than they were a few months ago, and that they would continue to improve for at least a year after the war came to a close. Then there was bound to be a great financial reaction, and the Pacific Northwest was bound to feel it, but in great deal less degree than the East. He said he firmly believed in financial, industrial and military preparedness, as Europe would put forth as great an effort industriously as she has in a military way, and that we must be in a position to take care of all of our people after the European war is over.

A. C. MacMicken gave a synopsis of what was going to be done in Portland to observe America's Electrical Week.

The Northwestern Electric Company furnished three prizes, which were given out to the winners of the following contests:

First—Five names were drawn from the members attending the luncheon and they were given small rubber balloons to inflate with their mouths. The first one breaking

same was winner of the contest. Mr. Cook of the Ohio Brass Company won an electric grill.

Second—Five more names were drawn, and the contest now was to take a bite out of an apple suspended on a string without aid of your hands. Mr. Howe won an electric toaster.

Third—Again five more names were drawn and a feather-blowing contest was put on. Mr. Dennis won an electric water heater. Attendance 95.

Next luncheon on November 8, 1916, will be handled by the Oregon Society of Engineers, and the speaker of the day will be Mr. Fred F. Henshaw, United States Geological Survey, and his subject will be Hydrometric Work in Oregon."

California Association of Electrical Contractors and Dealers.

The regular monthly meeting of the association was held at the Palace Hotel, San Francisco, on the evening of October 26th, there being about 90 contractors and jobbers present.

C. F. Butte, as chairman of the meeting, first called upon Dr. J. H. Graves, who gave a brief address on "Compulsory Social Insurance," presenting the same argument as was published in these columns last week in the report of the Electrical Development and Jovian League at San Francisco.

A. H. Halloran, Pacific Coast representative of the Society for Electrical Development, then explained the purpose of America's Electrical Week and how it was to be observed throughout the country. He showed particularly the way in which electrical contractors may tie in and cash in locally on this national advertising campaign by co-operation with the society's committees in general activities and by making window and store displays and demonstrations. The necessity of attracting visitors to these exhibits by means of letters and newspaper advertising was emphasized, as was also the advisability of enthusing salesmen in the work. The essence of his remarks was contained in the thought that if the contractors did their part in participation they would gain their share in profits.

George H. Haller read a paper in which he made the assertion that no general rule was applicable for ascertaining overhead, claiming that some lines require a greater allowance for overhead than others. Likewise he thought that a uniform price schedule was impracticable and to combat price cutting on one article, such as a battery, he suggested that efforts be concentrated on a competing article, such as a bell ringing transformer. As a substitution for vicious cutting of prices on nationally advertised specialties as leaders, he suggested that prices be reduced on staples, or that the dealers make a special drive on a brand of their own.

Louis Levy then gave some interesting remarks on electrical merchandising, arguing against the practice of special sales. His experience showed that a 40 per cent margin was essential to retail dealers. With regard to advertising, he makes a practice of setting aside 2 per cent of his gross sales as a regular investment. He concluded with a strong argument in favor of fair treatment of competitors.

H. C. Reid then read an interesting paper on construction from a contractor's viewpoint, first giving credit to the jobber, central station and press for their help in improving the construction end of the business. He read an editorial from a recent issue of the Journal, entitled "A Loss There Was," and then amplified a number of points by showing the necessity for the contractor knowing the cost of doing business. He made an earnest plea for an overhead allowance of more than 10 per cent. He also advised systematizing of estimates and spoke briefly on unit costs, costs of warehousing and handling goods and legislative and municipal reforms.

In response to a request that he speak from the jobber's standpoint, W. S. Berry told of the success of the Telephone and Telegraph Society in educating its employees as to the aims of the companies and as to proper methods of doing

business. He stated that all jobbers are anxious to interest the public in different lines, and that the Pacific Coast jobbers look upon the dealer as the right channel for distributing goods. He also urged co-operation with the hardware dealers and department stores.

C. E. Wiggin spoke of the value of acquaintance and co-operation in promoting the good of the electrical business and bespoke a greater exercise of the spirit of brotherly love.

D. E. Harris stated that the jobbers are in accord with the policies outlined by the contractors and dealers and likewise suggested closer affiliation with the hardware men. He showed that the purpose of modern business is to satisfy and serve the customer and that this objective can be reached by closer co-operation.

S. V. Walton complimented the association on its progress in organization during the past two years and urged that more branches of the business be included and that the organization be still further perfected. With regard to America's Electrical Week, he stated that during that period the Pacific Gas & Electric Company would forget that it was in the gas business.

A. B. C. Dohrmann gave the principal address of the evening, treating on the problems of the dealer and retailer. He introduced his remarks by saying that the information that he acquired during the evening concerning America's Electrical Week more than repaid him for five years' dues in the association. Such work as is being done by the Society for Electrical Development would not be possible without organization and co-operation. He commended like action to the contractors, emphasizing the importance of patience in the achievement of results. He stated that it takes time to educate one another, but that, like the good will of a business, results are rapidly compounded. He defined efficiency or scientific management as being even more essential to success than standardization of prices. "Efficiency is knowing what you ought to do and then going ahead and doing it." He illustrated his remarks by the success of the Retail Jewelers' Association in California during the past six years. They first ascertained what was the cost of doing business and then acted accordingly. He said he never feared a competitor who was making money. He suggested that the organization help competitors to make money. He cited his own experience in directing ten retail stores and stated that during 1915 they sold \$180,000 worth of electrical appliances, with a gross profit of 41 per cent. He emphatically stated that the cost of conducting a retail business requires the same percentage in a small as in a large business; this percentage averages 34 per cent. This means that manufacturers should give the dealers a chance to make a gross profit of at least 40 per cent. He stated that modern department stores no longer feature leaders, this being a relic of a bygone age. He particularly urged that the dealers take time to talk over matters with their competitors and agree upon a mutual basis for doing business. He concluded his remarks with favorable comment on the recent change in the attitude of the Government towards trade organizations, finally stating that electrical merchandise must be distributed through those channels most convenient to the distributor.

J. R. Tomlinson of Portland then spoke briefly of the good progress made in that commonwealth by the electrical contractors and dealers, briefly stating the purposes of the Western Conference Board.

H. C. Rohrbach of Tacoma, who was also in attendance at the meeting of the Western Conference Board, expressed the good wishes of the Washington Association of Electrical Contractors and Dealers.

G. E. Arbogast, representing the Southern California Electrical Contractors' and Dealers' Association, after commenting upon Mr. Dohrmann's remarks, emphasized the necessity

of a greater profit to be allowed the dealers by the manufacturers.

Frank Somers, president of the association, humorously reviewed the remarks of the previous speakers and urged immediate action in the matter of an increase of discount on heating appliances. He read a communication regarding the progress of the British Columbia Association.

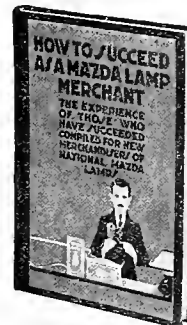
Leroy Smith, secretary of the California State Hardware Association, explained that they were willing and anxious to co-operate with the electrical men. H. P. Newman spoke likewise for the Plumbers' Association.

The meeting was closed by an interesting address by Albert H. Elliott, who eulogized Mr. Dohrmann's work in teaching retailers the necessity for making proper provision for overhead and profit. With regards to a recent trip throughout the Northwest, he showed that similar troubles confronted all the contractors of the territory and could be solved by more or less standard methods. He spoke particularly of the value of an association with strength and power enough to help its members. He suggested that the contractors through their association adopt fixed business policies and stand by them. There being no other business before the association, the meeting adjourned at a late hour.

NEW CATALOGUES.

"Railway Motor Gears and Pinions" is the title of Bulletin No. 44419 just issued by the General Electric Company.

The Bureau of Mines has just issued a most useful booklet of 110 pages on "Rescue and Recovery Operations in Mines After Fires and Explosions."



"How to Succeed as a Mazda Lamp Merchant" is the subject of a 160-page book just published by the National Electric Lamp Association of Cleveland, Ohio. This high-grade sales manual, "the experiences of those who have succeeded, compiled for merchandizers of National Mazda lamps," . . . "is simply a series of guide posts set up for the people who prefer to let others make their mistakes for them." It is made up of short, snappy talks by the leaders in the lamp business—W. G. McKittrick, H. M. Vanzwoll, C. W. Bender, J. E. Randall, J. A. Vandegrift, N. H. Boynton, T. K. Quinn, R. E. Scott and P. F. Bander. It covers every phase of the manufacture, distribution and sale of Mazda lamps of all styles and types. Its suggestions are valuable to any salesman, but particularly so to lamp salesmen. With everything to commend it and nothing to condemn it, this book should be in the hands of every electrical dealer.

BOOK REVIEW.

Examples in Alternating-Currents, Vol. I. By F. E. Austin, diagrams and tables. Edited and published by F. E. Austin of Hanover, N. H., and for sale at the Technical Book Shop in San Francisco. Price forty cents for cloth binding, and one dollar ten cents for flexible binding.

For the student who is looking for a clear, concise layout of problems that involve alternating current computations this is the book. While the book has been designed to assist the college student, it will be found valuable to those who are pursuing correspondence courses or who are attempting the study of the subject by themselves. The book starts with curves showing typical alternating current waves, and then builds up the mathematical treatment of alternating currents first by use of geometry, then trigonometry and finally calculus. The examples are well chosen and are clearly set forth. This is the second edition of the book.



NEWS NOTES



INCORPORATIONS.

POCATELLO, IDAHO.—Articles have been filed with the county recorder at Pocatello, Idaho, for the Electrical Machinery & Engineering Company. The purpose of the new concern is to construct, repair, install and build electrical appliances of all kinds, to act as electrical and mechanical engineers, and to receive and store electrical supplies.

SACRAMENTO, CAL.—The Honey Lake Valley Mutual Water Users' Association, capitalized at \$1,600,000, has filed articles of incorporation. It is the object of the association as set forth in the articles to acquire and develop facilities for supplying water for irrigation and other beneficial purposes to shareholders at cost. The incorporators and directors for the first term are: C. W. Hallowell, W. D. Minckler, and William D. Minckler, Jr., of Susanville, and F. W. Collins and Carl J. Young of Reno.

ILLUMINATION.

EPHRATA WASH.—The council has decided to install some new lights.

BAKER, ORE.—Work of installing cluster lights on Main street was started about November 1.

TULARE, CAL.—Bids for installation of an electrolier street lighting system will be received up to November 6th.

NEWPORT, WASH.—The Idaho Power & Concentrating Company is preparing to ask for a franchise to furnish light and power to Sandpoint.

BOZEMAN, MONT.—A franchise for a gas plant has been requested by R. W. Lysle of Chicago, who contemplates constructing a \$150,000 plant.

DALY CITY, CAL.—The supervisors have decided to install additional lights on El Camino Real south of Holy Cross Cemetery to South San Francisco line.

PHOENIX, ARIZ.—Voters of Phoenix defeated the proposition for the issuance of city bonds in the sum of \$600,000 for a municipal electric light and gas plant.

KINGMAN, ARIZ.—The Desert Power & Water Company is rushing a line across the desert toward Chloride as fast as possible. It is believed that Chloride will have electric lights within three weeks.

TACOMA, WASH.—Bids are being received by the commissioner of light and water for furnishing \$10,000 worth of incandescent lamps to be delivered according to specifications on file with the commission.

HOLLYWOOD, CAL.—The F. S. McEwan Electric Company of Santa Monica has been awarded the contract for installing ornamental lights on Hollywood boulevard, between Cherokee and Wilcox avenues.

CENTRALIA, WASH.—W. F. Sheppherd has purchased the L. A. Webb interests in the Central Light & Power Company, and is ready to improve the plant and system and to furnish light and power to Pe Ell.

WATTS, CAL.—The board of trustees has received a petition for the improvement of East Albert street by the installation of ornamental electroliers and has instructed the engineer to prepare a resolution of intention for same.

PORT ANGELES, WASH.—The bid of Chas. S. Kidder & Company, bankers of Chicago, for the \$25,000 worth of electric light bonds offering a premium of \$1025 was accepted as the best bid. The bonds are required to retire warrants and provide for extensions of the lighting system.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to November 13, for installing

an addition to the system of street lighting in the Verdugo Lighting District, the work to be performed in conformity with any instructions which may be given by the Board.

SOUTH BEND, WASH.—The Willapa Power Company has just completed the installation of a modern street lighting system in South Bend which, according to F. R. Nettleton, manager of that company, puts that city in a class by itself on the lighting question—\$3500 being expended on the work. Improvements planned by the company for next year include the construction of a dam and power plant four miles nearer the headwaters of the South Fork of Willapa River than the present plant and the building of a new power plant. These improvements will cost \$35,000. This will give them 45 ft. head water with a developing capacity of 1200 h.p. A Jos. Leffel turbine wheel has been ordered through the Colby Engineering Company of Portland for the new plant. Also a 300 k.v.a. Western Electric generator. A suit is now pending between the Willapa Power Company and the city of Raymond over this site. The city claims it for a water source.

TRANSMISSION.

LA GRANDE, ORE.—J. Melville was awarded a contract for the city heating plant at \$2383.

BANNING, CAL.—The light and power utility has purchased a site at Ramsey and Second streets and will erect a two-story building for office and shop purposes.

BUTTE, MONT.—A. A. Dockstader, city clerk, states that an ordinance has been passed granting a franchise to the Montana Power Company for heating and steam plant privileges in certain streets.

SEATTLE, WASH.—The purchase of a completely developed power plant at a cost of not to exceed \$3,000,000 is proposed under the terms of an ordinance which has been introduced by Councilmen Thomson and Moore.

DAVENPORT, WASH.—The Washington Water Power Corporation has filed a petition with the county commissioners asking for a franchise to construct an electric transmission line along the county roads in Lincoln county.

OROVILLE, CAL.—Encouraged by the showing made at the Robinson mine at Granite basin in Plumas county, the United States Exploration Company is making elaborate plans for a continuation of development work this winter. The company plans to sink to the 400 ft. level. If the ore showing continues as good as it is now, by June next work will be started upon a 50 horsepower hydroelectric plant and upon a flotation plant capable of handling 100 tons of ore a day.

SAN LUIS OBISPO, CAL.—The Midland Counties Public Service Corporation is preparing to extend its power lines in various parts of this and Santa Barbara county, and are branching out for more business for their electric service. It is reported the parent company known as the San Joaquin Light & Power Company, has appropriated \$300,000 for additions to the service. Arrangements are reported to have been made for establishing a branch line to Avila and that later the towns of Morro, Caucos and Cambria will be supplied.

SAN FRANCISCO, CAL.—The Northern California Power Company Cons., has taken an option for five years in Trinity county on the Weaverville Electric Company's plant, and will extend its line to Weaverville. It may also extend to Junction City, where connection will be made with the lines of the Western States Power Company, that serves Eureka. The Northern has just completed an extension of its lines from the substation at the Washington mine near French Gulch, to Lewiston, a distance over the mountains of eight miles.

TELEPHONE AND TELEGRAPH.

BILLINGS, MONT.—The Mountain States Telephone Company is spending \$80,000 in telephone work here.

CENTRALIA, WASH.—The matter of granting franchise to the Pacific Telephone & Telegraph Company will be referred to the voters.

BOISE, IDAHO.—The project Mutual Telephone Company has filed an application to extend its telephone and electric light system in Rupert.

KENNEWICK, WASH.—An ordinance has been passed by the city council granting to A. F. Brown a franchise to extend the telephone and telegraph system in the city of Kennewick.

WENATCHEE, WASH.—E. H. MacDaniels, forest supervisor, has applied to the county commissioners of Chelan county for a franchise to operate a telephone line over the several roads.

BOISE, IDAHO.—The Project Mutual Telephone Company has filed application with the public utilities commission for permission to extend its telephone and electric light project over the Minidoka project.

SAN MATEO, CAL.—Judge Buck has signed a decree ordering the city of Hillsborough to reconvey to the Burlingame Land & Water Company three parcels of land in Burlingame Park. The original owners now want to sell it to the Pacific Telephone & Telegraph Company as a site for new telephone exchange.

MODESTO, CAL.—The local exchange plans to expend \$10,000 for enlarging the telephone system. Plans have been received by Manager E. Garner, and call for three new lines from Modesto to Oakdale, Empire and Hughson. A 25-pair cable line will span Dry Creek. The open wire work on Needham avenue will be replaced with lead covered cable, 200 ft. beyond the city limits.

TRANSPORTATION.

THREE FORKS, MINN.—The power company will erect a 75x85 ft. brick building.

SEATTLE, WASH.—The sum of \$100,000 will be expended by the Seattle, Renton & Southern Railway in the construction of track and paving of street intersections in the Genessee street extension, and the construction of tracks on Dearborn.

TACOMA, WASH.—The Tacoma Railway & Power Company will spend several hundred thousand dollars on work of remodeling the car barn building at the corner of Thirteenth street to provide new general offices. The street car company will make other improvements as follows: Extension of Pacific avenue line from South Thirty-fifth to South Forty-eighth street, and the construction of South Tacoma tracks over the Tacoma avenue fill.

SPOKANE, WASH.—A preliminary announcement of the electrification of the Great Northern Railway Company was made in the columns of the Journal of October 21, 1916. It is now further announced that this company is to develop the Chelan River and Lake Chelan hydroelectric power scheme the coming year to develop 150,000 h.p. to operate the company's lines from Spokane to Seattle. It is also possible that the coast line of the Great Northern between Vancouver, B. C., and Portland will be included in the development. This would mean the electrification of 500 miles of line and the expenditure of \$16,000,000 to \$20,000,000.

IRRIGATION.

PARADISE, CAL.—As all the proceedings of the irrigation board have been adjudged legal, petitions calling for a bond election for the district will be in circulation in the near future.

SACRAMENTO, CAL.—John D. Guerraz of Edendale, Santa Clara county, has applied for permission to appropriate waters of a small stream in Piercy subdivision, near Edendale for irrigation of 40 acres.

STOCKTON, CAL.—At a recent meeting the council planned for the installation of a pumping plant at Yosemite lake. As the present system cannot handle overflow during high water, a centrifugal pump will be installed.

LINDSAY, CAL.—The bonds of the Lindsay-Strathmore irrigation district, in the sum of \$1,400,000 have been sold to Harne & Co., of Los Angeles at par. Mr. Kennedy, the contractor, states that construction work is progressing rapidly.

OWENYO, CAL.—Geo. J. Evans of Lone Pine and Owenyo has applied for permission to appropriate water in two different places for agricultural purposes in Inyo county; one from Waucoba Creek and Lead Canyon Springs, and the other from Upper Warm Springs, tributary to Lower Warm Springs.

SACRAMENTO, CAL.—W. F. Fowler of Willows has applied for permission to appropriate 250 cubic feet per second of the waters of the Sacramento River for rice culture on 14,000 acres. The water will be raised by electrically-driven pumps to the main canal which is given as 10 miles in length. The proposed works will cost, at an estimate, \$180,000.

ALPAUGH, CAL.—The work on the different lines of development undertaken by the irrigation district is progressing rapidly. The pipes for the domestic water system are already laid. The foundation for the 65,000 gallon tank is finished and work has been started on erecting the tower. The reservoir is ready for the concrete. Two of the pumping plants at Smyrna are already finished.

ELLENBURG, WASH.—C. W. Johnstone, secretary of the Kittitas Reclamation District, commonly known as the High Line Canal District, announced that the directors had granted an option on the \$5,000,000 bond issue to a syndicate headed by the Twohy Bros., contracting firm of Spokane and Portland. The option calls for the construction of the entire canal projected by the syndicate, which is to take the bond issue as pay.

FRESNO, CAL.—The proposition to reclaim 262,000 acres of the Tulare Lake basin and construct a reservoir and canals to hold the lake waters for irrigation purposes, at a cost of \$6,000,000, will soon be presented to the State Reclamation Commission. It is planned to confine the lake to a reservoir covering 20,000 acres, to lead the water into the reservoir from the various rivers and streams flowing in to the lake, and to provide canals to carry off the surplus water.

DIXON, CAL.—A meeting was held here last week to consider data regarding irrigation and comparative facts and figures from this and other irrigated sections of the state. If it seems feasible, and the time opportune, steps will be taken for the formation of the Dixon Irrigation District, the object of which will be to supply cheaper and more abundant water than is now had under the pumping plant plan. C. H. Loveland, R. W. Hawley and H. A. Whitney, engineers, have made superficial examination of dam sites and reservoirs. They report three possible reservoir and dam sites.

SAN FRANCISCO, CAL.—The Landis Bros. of San Francisco have applied to the State Water Commission for permission to appropriate 100,000 acre feet per annum of the waters of Dry Creek, tributary to Mokelumne River, in San Joaquin and Sacramento counties. The diversion proposes a concrete multiple arch dam 60 ft. high, 1400 ft. on top and 1200 ft. on bottom, which shall serve the purpose of both storage and diversion dam. This it is proposed to locate on the Arroyo Seco ranch. The estimated cost of the project is given as \$1,000,000, and it is contemplated to water 100,000 acres. The commission has allowed the applicants until May 1, 1917, to file complete data and maps.

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SAN FRANCISCO, NOVEMBER 11, 1916

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THE MOST POWERFUL GOLD DREDGE AFLOAT.

BY ROBERT SIBLEY.

ELECTRIC POWER TRANSMISSION IN LOGGING

BY ALLEN E. RANSOM.

DOMESTIC LAMP SOCKET HEATING DEVICES.

BY E. A. WILCOX.

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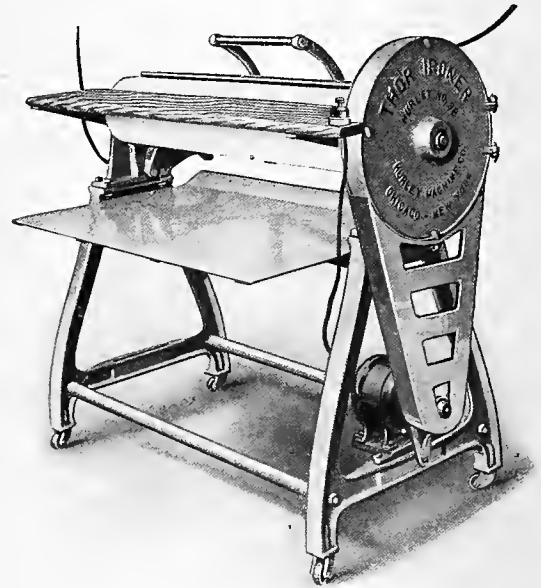
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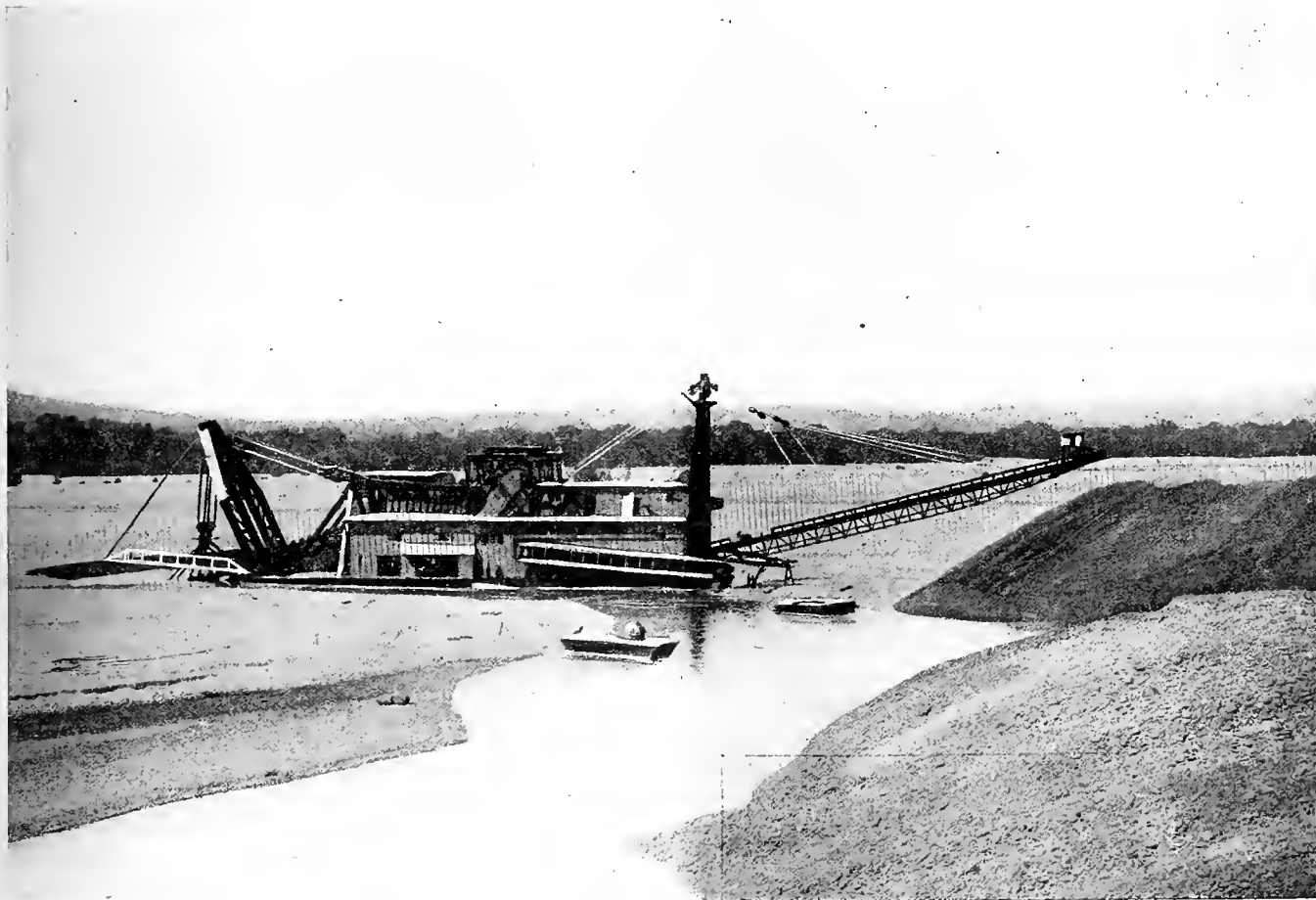
THE MOST POWERFUL GOLD DREDGE AFLOAT

BY ROBERT SIBLEY.

During the past twenty years hydroelectric development in California and the West has been nurtured from infancy to its present gigantic proportions.

This identical period is also noteworthy for a second brilliant accomplishment—namely that of the evo-

West, a brief resume of the principles involved in its operation together with some of the interesting details of a mammoth new dredge, recently put into operation at Hammonton, California, should not prove amiss at this time.



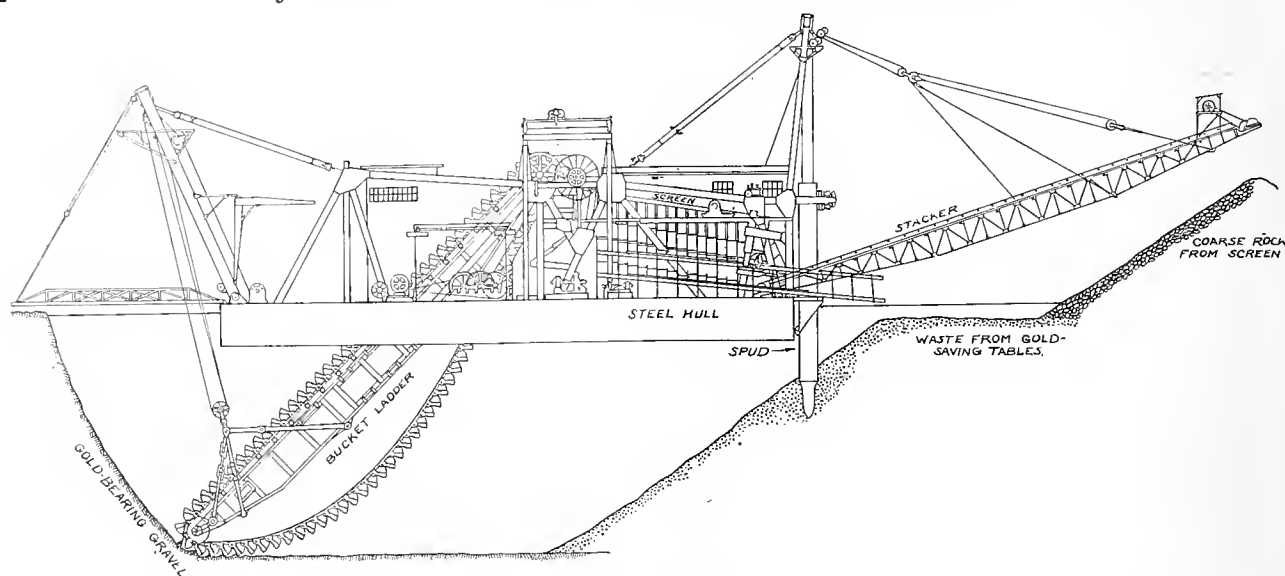
The Yuba No. 15—The Most Powerful Gold Dredge Afloat.

lution of the modern electrically operated gold dredge, which today, like a monster nautilus, is eating its way into the gold-bearing gravels of northern California, and disgorging from its iron-clad shell each month hundreds of thousands of cubic yards of valueless material, but retaining for the use of man the precious metal so necessary in the activity of commercial life.

Since gold dredging now constitutes an important electrical load for the various power companies of the

This latest and newest type of gold dredge is the most powerful in existence. Its buckets are of $17\frac{1}{2}$ cu. ft. capacity, its depth of contact with the gold-bearing gravel is 84 ft. beneath the water level and its washings per month bring forth the hidden treasure stored in 300,000 cubic yards of river gravel.

In prehistoric times, perhaps thousands upon thousands of years before the advent of man, the present area occupied by the high Sierras was composed of compar-



Side Elevation Showing Bucket, Screen and Stacker.

actively level country that stretched up into Oregon and probably out across Nevada and Utah. Slow moving rivers trailed their way through this vast area and emptied themselves into a gigantic fresh water lake which is now the great interior basin of the Sacramento Valley. These rivers gradually deposited gold-bearing sediment as they passed onward in their course to this inland lake. As to just where this gold came from is not definitely known. At a later period, however, volcanic action covered these river deposits with mud and ash. Subsequently the uplift of the Sierras occurred and from comparatively low lying stretches of land these mountains rose to heights far in excess of their present towering pinnacles. The ancient stream beds were thus warped out of position, new and far more rapidly moving rivers were formed, the fresh water lake became land and the Coast Range came up out of the sea. The net result was that new gold deposits were made and new adjustments of river bottoms took place so that today the chief source of gold supply comes from this later deposit which has as its bedrock the volcanic ash and mud above mentioned, with a deeper and richer gravel deposit beneath. This latter deposit has not been prospected to any great depth as it is thought to be uneconomical to reclaim its gold with present methods of recovery. As an instance of the existence of this lower stratum of gravel deposit, the well sunk by a well known mining engineer may be cited. At a depth of 68 ft.

the upper river gravel ceased and volcanic bedrock was encountered. This volcanic formation ceased at the 84 ft. level and gravel again was encountered. At 114 ft. the work, still in gravel, was discontinued as the purpose for which the well was dug—that of water development—was accomplished at that level, nevertheless the digging clearly showed the existence of the lower stratum of gravel beneath the volcanic bedrock.

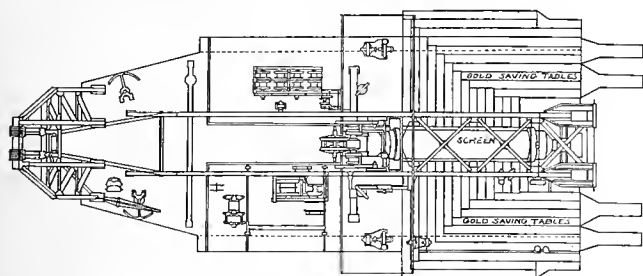
In its simplest analysis the gold dredge is a hull which floats in an artificial pond that the dredge itself continually creates. In its front is a long ladder, inclining downward into the gravel bank to be dredged. This ladder has upon it a massive endless chain of buckets that are caused to revolve and scoop up the gold-bearing gravel. In order to recover the gold, this gravel must be thoroughly washed. To accomplish this the buckets upon the ladder dump their contents into a huge revolving screen in which streams of water play upon the gravel. This water washes the gold and the finer particles through the perforations in the screen. The coarser material, thoroughly washed, is dumped from the revolving screen upon a stacker. This stacker rises upward from the rear of the dredge and is operated by means of a long rubber belt which conveys the rock and gravel to a height sufficiently in the rear to dispose of this washed material so that it will not interfere with future operations of the dredge.

The finer material which contains the gold, having been washed through the screen, is dumped upon gold saving tables and there the gold is recovered. Since gold is heavier than the other material with which it falls from the revolving screen, it quickly passes to the bottom as it journeys over the gold-saving tables. Upon these tables are constructed riffles or obstructions which are inlaid with mercury. As the gold passes over this mercury there is found to be a great affinity between it and the mercury, consequently an amalgam is formed. Meanwhile the other fine material now free from gold is washed on down into the rear of the dredge where it is deposited near the coarser material above mentioned as coming directly from the screen.

Three or four times a month the gold-saving plates are cleaned of their amalgam, which is then heated in an oven. This heating process soon evaporates the mer-



Giant Dredge Bucket of Seventeen and One-Half Cubic Feet Capacity.



Looking Down Upon Dredge showing Revolving Screen and Gold Saving Tables.

cury, leaving the free gold that is later shipped to San Francisco as gold bullion. The mercury which has thus been evaporated is later recovered by condensation and used again in the riffles for entrapping the free gold.

The dredge is held in position during its activity by means of heavy steel shafts known as spuds, which are raised vertically and allowed to fall due to their own weight, thus pinning the dredge to a stationary position in the dredge pond. For additional security guy wires are run ashore and securely lashed. When it is desired to move the dredge forward one spud is raised and the other anchored. By means of the guy wires and the alternate raising and lowering of spuds the dredge is then stepped forward "turkey fashion" as the small boy would say.

The new powerful dredge at Hammonton is of the bucket elevator type and is designed to dig to a depth of 84 ft. The hull on which the machinery is installed is of structural steel and the housing is of fireproof construction.

The buckets are approximately $17\frac{1}{2}$ cubic feet capacity. The bottom and hood of the buckets are a single manganese steel casting with 41 in. between pin centers. The bucket pins which fasten the buckets to the endless chain, are $7\frac{3}{8}$ in. in diameter by 33 in. long.

These buckets in an endless chain procession, revolve about upper and lower tumblers, the former a high carbon steel casting and the latter made of manganese steel. The digging ladder which supports the tumblers and the endless chain of buckets is of the plate girder type.

The upper tumbler shaft is driven at both ends through a double train of gears. The pulley shaft is of the differential type and thus divides the load equally between the two trains of gears.

The revolving screen into which the buckets dump their load of gravel is approximately 9 ft. in diameter by 50 ft. 6 in. in length. The perforated plates of which this screen is made are of $\frac{5}{8}$ in. thickness and are made of high carbon steel. The perforations taper from $\frac{3}{8}$ in. in diameter on the inside to $\frac{1}{2}$ in. in diameter on the outside for the first, second, third and fourth sections of perforated plates. The lowest or fifth section of perforated plates has perforations tapering from $\frac{1}{2}$ in. on the inside to $\frac{5}{8}$ in. on the outside. Manganese obstruction rings are provided at the lower end of each of the screen plates to assist in thoroughly washing the dredged material. The drive for the revolving screen is of the friction roller type.

Two spuds are provided for anchoring and for stepping the dredge ahead. These are 38 in. wide by 60 in.

deep in section and are about 70 ft. long. They are built of steel plates and angles with cast steel spud joints.

Under the revolving screen is a distributor of new design made of steel plates. Its function is to distribute the fine gold-bearing material passing through the screen so as to properly load the different sets of gold-saving tables.

The gold-saving tables are made of $\frac{1}{8}$ in. steel plates. The sides of each sluice are formed by flanging up the bottom plate. This avoids any seams in the corners in which mercury and amalgam may be lost. The tables are of the double deck type and have a total area of approximately 8000 square feet. The riffles that are used on the gold-saving tables and in the side sluices are of wood, shod with $\frac{1}{8}$ by $1\frac{1}{4}$ in. steel straps.

For washing and sluicing purposes several centrifugal pumps have been provided. There are two fourteen inch centrifugal pumps of 5500 gal. per minute capacity, one operated by a 150 h.p. motor against a head of 70 ft. and the other by a 75 h.p. motor against a head of 40 ft. There is also a six-inch, two-stage, centrifugal capable of delivering 1000 gal. per min. against a head of 120 ft. operated by a 50 h.p. motor, and in addition a four inch centrifugal pump capable of delivering 450 gal. per min. against a 65 ft. head operated by a 15 h.p. motor. Other smaller pumps are also installed.

A distinct advance is made in the electrical equipment of this dredge over any previous installation of this type. In general the electrical equipment is the same as that installed on the sister dredge Yuba No. 14, which is itself a model in electrical design. The main digging motor on that dredge is rated at 400 h.p., 514 r.p.m., 3-phase, 60-cycle, 440-volt, three-bearing slip-ring type with master controller, contactor, panels and resistance good for 50 per cent speed reduction. On that dredge, too, the contactor equipment is provided with inverse time limit overload control for alternating current operation.

The main motor on Yuba No. 15, on the other hand, is rated at 500 h.p. with contactor control, but this control is operated by direct current from a motor generator set installed on the boat. This gives a steady volt-



Channel in Which Dredge Operates.

age for the operation of the contactor control and eliminates the fluctuations that would be felt on the alternating current operated control caused by the operation of the digging motor. The total installed capacity of motors on the Yuba No. 15 is 1007 h.p.

The switchboard is an improvement over the board furnished for the Yuba No. 14 as it embodies all the latest safety features and is made as "dead front" as possible. The motors are started through double throw automatic oil switches, thus doing away with starting compensators on the dredge.

Unfused disconnecting switches have been added to each motor panel, placed in the circuit ahead of the oil switches in order to entirely disconnect the oil switches and motors from the line. These switches are all provided with insulating covers. The entire equipment is designed with an idea of "safety first" so as to protect the operator from coming in contact with live parts.

The mammoth dredge known as Yuba No. 15, which has been described above was built by the Yuba Construction Company of Marysville, California, of which Mr. Newton Cleaveland is general manager. The dredge was about four months in construction and cost nearly four hundred and fifty thousand dollars.

SAFETYGRAMS.

The Bureau of Safety suggests the following "safetygrams" which merit the serious consideration of all:

"Carelessness is one crime where punishment is quick and sure.

"It is better to take pains in preventing accidents than to suffer pains as a result of them.

"It is easier to do a thing right than to explain why you did it wrong.

"An ounce of forethought is worth several pounds of substantial regret.

"Isn't it funny that everyone thinks that the sign 'This Means You' was put there for the other fellow?

"Accidents do not just happen. They are caused.

"Hold your temper—nobody else wants it, and besides, it may cause an injury.

"Your company tries to protect you. Are you doing your share to help?

"Carelessness is the short cut to death.

"Keep accidents down, or they'll keep you down.

"The only place a chance taker can find sympathy is in the dictionary."

Pasturing sheep on the canal banks of the Salt River project has been successful in controlling Johnson grass and also profitable. It has been found that the Johnson grass can be controlled and eventually eliminated, the use of the sheep also decreasing the cost of cleaning the canal. The sheep drive out the gophers and thus cut the cost of repairing breaks and reduce the loss of water by seepage to a minimum. In 1914 the sheep became so fat in 90 days that their effectiveness as "cleaners" was reduced and it was necessary to market the band. For the season 1914-15 there was an actual profit of over \$400 on the sheep, the wool and increase more than covering the cost of herding. In addition there was an estimated saving of \$4000 in canal maintenance. A total of 45 miles of canal and 32 miles of laterals were pastured, 1290 sheep and goats being in the bands in November, 1915.

ELECTRIC POWER TRANSMISSION IN LOGGING.

BY ALLEN E. RANSOM.

(In recent years electrical applications in logging have been on such an increase that today they are a vital part of the operation of the logging industry of the West. This interesting paper was read before the recent Pacific Logging Congress at Portland, Ore.—The Editor.)

The use of electricity in the lumber and logging industries has been the subject of many papers and discussions during the past decade and particularly with reference to the electric logging donkey and its various applications and relative advantages over the steam donkey in safety, fuel consumption, etc.

In connection with the use of the electric donkey, the questions and problems of getting electric power to the point of service are worthy of note and are in a general way the text of this paper.

In some ways electricity is analogous to a pipe carrying water. Electrical voltage has its equivalent in the pounds of pressure exerted by the water in the pipe; amperage is directly analogous to the quantity of water; while the size of the transmission wire is equivalent to the diameter of the pipe.

The flexibility of the alternating 3-phase, 60-cycle current has made it the standard in the electrical field for the transmission of electrical energy. By means of transformers the current can be stepped down or up to any voltage desired for different distances of transmission. The higher the voltage, the greater the distance the current can be transmitted with the least loss and least investment for transmission wire.

Owing to the changing locations of logging camps it is generally impracticable to build a power generating station of either the steam or water driven type for this service. Consequently the source of energy is generally a logging company's sawmill; a transmission line of a larger power company; or from a transmission line from the mill along the logging road to the point where it can be taken off at a lower voltage for the camp.

The possible power requirements of a two-engine logging camp can be roughly estimated as follows: 2 electric donkeys, 300 h.p.; blacksmith shop, 10 h.p.; camp lighting installation 5 h.p.; portable compressed air plant 15 h.p.; heating and cooking (possible with cheap power), 30 h.p.; total demand 360 h.p.

As a rule all this power is seldom on at one time so that a capacity in the transformer station or mill plant available for use at the camp may be considered at 300 h.p. or basing on one kilowatt at the generating or substation plant for each horsepower used at the camp. A transformer capacity of 300 kw. in three 100 kw. units should be provided.

The voltage used on the donkeys is generally 440 volts and the transformer can be provided with taps for either 220 or 110 volts for the other requirements of the camp.

The voltage used in the transmission of power depends upon the distance of the camp from the source of power. For a camp requiring 300 kw. the following table is of interest. The loss in power in the following installations would not exceed 10 per cent.

Distance from source of power.	Voltage at camp transformer.	Size of copper wires.	Weight of Wire per 1000 ft. (single)	No. of wire
4 to 6 miles.....	2200	No. 2	200 lbs.	3
8 to 10 miles.....	6600	No. 4	126 lbs.	3
12 to 15 miles.....	13200	No. 6	80 lbs.	3
20 to 25 miles.....	22000	No. 6	80 lbs.	3

The transformers at the camp, therefore, would have to have their primary voltage based on the distance from the point of origin, while the secondary voltage would be the same in all cases, either 440, 220 or 110 volts. The line construction for any of the voltages specified can be standardized with the exception that the spacing of the wires must be increased as the voltage increases, which are as follows: 220 volts, 18 inches; 6600 volts, 24 inches; 13200 volts, 30 inches; 22000 volts 36 inches.

Different insulators must also be used for different voltages but the cost varies but comparatively little.

The country traversed determines to a great extent the length of the spans, but with copper wire of the sizes specified, 175 ft. does not cause too much sag. This is based on using 35 ft. poles, sunk 6 ft. in the ground.

The cost of transmission line per mile for 300 h.p. would be approximately the following, including material and labor:

35 ft. poles; 8 in. tops.....	\$ 3.50
Cross-arm, 4x5-4 pin .....	.40
3 iron cross-arm insulator pins.....	.45
3 insulators	1.50
2 galvanized cross-arm braces .....	.45
1 10x $\frac{5}{8}$ " cross-arm bolt .....	.10
3 3x $\frac{3}{8}$ " lag bolts for braces.....	.15
Framing poles and mounting materials.....	1.00
Digging holes and raising.....	1.00
Stringing wire per pole.....	1.25
Painting butts and cross-arms .....	.25
Total	\$10.05x35=\$351.75

In the above figures engineering and clearing are not included and the right of way is assumed free. The cost of the wire owing to the unsettled market cannot be estimated accurately. Assuming the cost of the wire to be 25 cents per pound delivered, the cost of the line per mile would be the following:

Size of line.	Labor and material.	Cost of copper.	Total.
2200 volts No. 2.....	\$351.75	\$25.00	\$1176.75
6600 volts No. 4.....	360.00	520.00	880.00
13200 volts No. 6.....	375.00	330.00	705.00
22000 volts No. 6.....	400.00	330.00	735.00

Increases in labor and material are due to the slightly higher cost of insulators and different cross-arm spacing for increased voltages. Due to the high price of copper some transmission companies are using a W BB grade of galvanized iron telegraph wire but owing to its high resistance and low conductivity as compared to copper, which is 16.1, care must be exercised in using it. A duplex metal copper-clad steel wire is also made and used to some extent. Aluminum is used on some lines but its conductivity is low, being about 63.1 in favor of copper.

Owing to the fact that the majority of camps are not very permanent, it is the writer's opinion that copper is the best conductor. It always has tangible value and it can be taken down and restrung on a new line without serious damage and it generally gives the best results. Aluminum is fragile and restringing it reduces its value.

A line built along the ideas mentioned herein can be moved or extended and its poles can be cut along the route. Upon change of location, the material can

be removed from the old poles and a salvage value of \$600 to \$1000 per mile realized from the original cost.

The camp transformer whether mounted on skids or on a train along the road can be served by the main wires at any voltage, at very little expense.

As to the distribution of power in camp, this offers little difficulty. The voltage is not greater than 440 and is not dangerous. The donkey motors are generally supplied direct from the main transformers by a 3-conductor flexible armored cable which can be as long as 1000 ft. if necessary and allowing that radius of action from the transformer station. The low voltage wires for the camp can be carried also in a 3-conductor cable and distributed at the camp for lights and other purposes. Small motors can be used for operating forge blowers, compressors, drill presses and similar tools. At the present time the electric cooking range has not become a general utility article for rough service, but it is not to be eliminated as a possibility for camp use where cheap power is available. The hot water bayonet type heater is a success and the air heaters are becoming more generally used.

All of these devices tend to reduce labor, and add to the general mobility of a camp. In cold, disagreeable weather it is a great comfort to be able to have light, power and heat instantaneously.

CARE OF FARM DITCHES.

Here are a few excerpts from the Reclamation Record that may assist the power salesman in giving helpful suggestions to a prospective consumer:

"How about the farm irrigation and drain ditches? No doubt the irrigation season just passed has found some faults in the layout, capacity, or efficiency of the ditches. Now is a good time to correct some of these faults.

"It is likely that one of the most serious drawbacks has been the presence of weeds in the ditches, hindering the flow of water and causing it to overflow low banks." More than likely these same ditches are now a mass of ripened weeds, depositing their seeds for a still more lusty growth next season. Gather up these weeds, with as little scattering of seeds as possible, and burn them. Make the piles for burning on spots where the most obnoxious weeds grow in order that their seeds will not be scattered and may be burned most effectively.

"Go over the ditches and, as far as is practicable at this time, remedy the weak spots. Build up low banks so the dirt will settle well before next irrigation season. Put in new or replace old checks where needed; remove the silt from the bottom of ditches and use it to fill borrow pits or low places near by. Don't make the mistake of building the banks higher at points where the ditches collect silt; you are making future trouble if you do. Keep the ditches cleaned out to the proper grade.

"The most important part of the irrigation work is done outside of the time you are actually irrigating. Removing obstacles to easy handling of water and having everything possible in full readiness makes for quicker, better, and cheaper irrigation. If you have a little time just before winter sets in, do some work on your ditches."

DOMESTIC LAMP SOCKET HEATING DEVICES.

BY E. A. WILCOX.

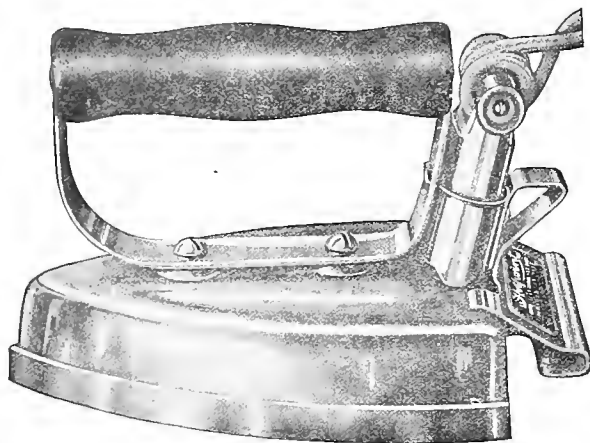
(In this article the author treats of certain electric heating devices that may be attached to the wiring system of the ordinary household without readjusting the wiring fixtures. The importance of a familiarity of the modern sales manager with such devices is apparent.—The Editor.)

Importance of Labor Saving Devices.

When we look back and think of how the housewife of the past was hampered in the performance of her duties, and compare these difficulties with her present day opportunities of making housework an enjoyable pastime, we naturally wonder whether it is possible for the future to bring forth conditions which will be any more ideal.

The various household labor saving devices which have so enormously transformed economic conditions are here classified, as well as possible, to set forth their chief points of superiority. Although a single device may produce only a small revenue, taken collectively these devices are of ever increasing importance in the production of profitable central station incomes.

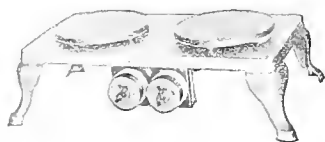
Electric Irons.—These were the first heating devices to come into universal use. They are now manufactured in many sizes, shapes and capacities and sold



Hot Point Iron.

in greater quantities than any other electrically heated device known.

The principal advantages of the electric iron over the old fashioned sad iron are saving in time and steps, even heat distribution, freedom from smoke, grease and soot, absence of excessive heat, and ease with which it may be used in any part of the house. Irons varying in weight from 3 pounds to 9 pounds and in capacities from 200 watts to 675 watts are available for domestic use.

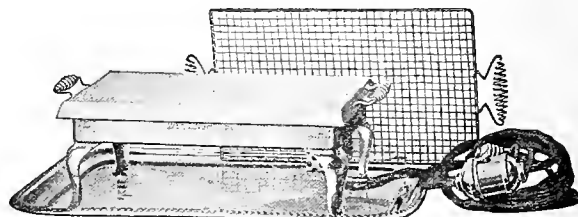


G. E. Twin Plate Disc Stove.

Electric Stoves.—Both the disc and open coil type are manufactured in various sizes and capacities. The disc stove has a metallic heating surface and delivers heat to the utensil by conduction. The open coil stove

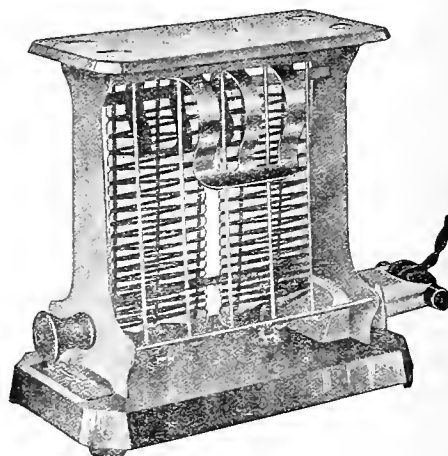
gives off radiant heat from exposed coils which are usually imbedded in grooves of porcelain or mounted above metallic reflectors.

Electric stoves are useful for many household purposes in place of gas or alcohol burners. They are suitable for heating water for various purposes, or for doing light cooking. They are safe, convenient and durable. For domestic lamp socket use they are seldom larger than six inches in diameter and 600 watts in capacity.



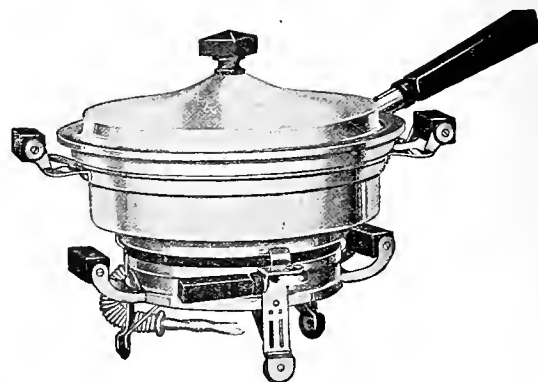
Westinghouse Horizontal Toaster Stove.

Toaster Stoves.—Two distinct types are made—horizontal and vertical. Toast made on the horizontal type will be produced quickly but will not be toasted through so well unless the bread be dry. Toast made below radiant coils or in the vertical type toasters will be produced slowly but will be toasted thoroughly. Vertical toasters are usually provided with a warming shelf on top to keep toast or other food warm.



Hot Point Vertical Toaster.

One great advantage of electric toasters is that they may be used on the dining room table instead of in the kitchen. From 400 to 600 watts are usually required for operating toasters.



Universal Chafing Dish.

Chafing Dishes.—These frequently have an outer pan in addition to the food pan for use as double boil-

ers. The food pans are made in two and three-pint sizes. The capacities vary from 250 to 600 watts. A wide variety of styles and ornamental types are available.

Electric chafing dishes are obviously safer to operate than alcohol or other flame types, and furthermore they give off no disagreeable odors or fumes.

Coffee Percolators.—Coffee made in an electric percolator is rich in flavor, free from grounds, and contains less caffeine and other harmful elements than boiled coffee. Starting with cold water, strong coffee may be prepared in from ten to fifteen minutes.



Hot Point Percolator.

Electric percolators in all styles, shapes and character of ornamentation and in sizes varying from four to nine cups are available. They usually require from 450 to 600 watts. They are ideal for use on the dining room table because they are attractive in appearance and also keep the coffee hot with practically no attention.

Tea Samovars.—The housewife who prides herself on her tea-making is pleased with a device where the tea-ball may be drawn up when the infusion is just right and a beverage served of fine flavor, and free from the bitter tannic acid taste that results from boiling tea-leaves in an ordinary pot. It is especially desirable for the afternoon tea because it can be operated in the living room. It furthermore does away with the disagreeable odors, fumes and dangers of alcohol or other fuel types.

Tea samovars are usually made in 5, 6 and 7 cup sizes and in capacities varying from 400 to 500 watts.

Tea Kettles.—Two and three pint sizes are usually made, requiring from 400 to 550 watts for operation. They are convenient and dainty for heating water for the tea service. They make an attractive addition to the table and possess the charm of a modern household luxury.

Table Cooking Outfits.—Single disc stoves supplied with a variety of hollow-ware utensils are called unit-sets, dining room sets or combination stoves. Coffee percolators, tea samovars, chafing dishes, nursery milk warmers, frying pans, tea kettles, griddle plates, and other utensils are included in the various sets.

These devices bring electric cookery within reach of its cleanliness, and convenience. For the hostess who does her own cooking the table cooking outfits are ideal. They are an ornament to any sideboard or table.



Simplex Dining Room Set.

Electric Grills.—Many handy devices for cooking on the dining room table, or in the sick room, and which are attractive and convenient, are made by various heating appliance manufacturers. The Hotpoint El Grillo is a useful table device. It may



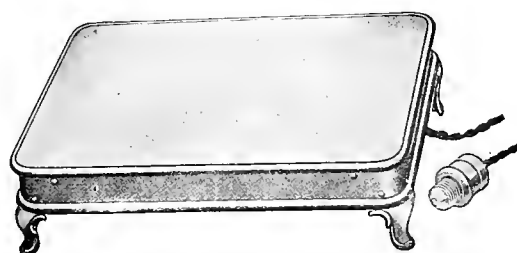
Hot Point Grill Stove.

be used for light toasting, frying and broiling as well as for boiling. Two of these operations may be carried on at one time as the utensils may be placed both above and below the glowing coils. It has a capacity of 600 watts and the dimensions of the heating element and pans are $4\frac{1}{4}$ by $8\frac{1}{2}$ inches.

The Westinghouse toaster stove is really a small complete cook stove. It may be used for broiling, frying, toasting, boiling or making griddle cakes. The stove is $5\frac{1}{4}$ by 9 by $3\frac{5}{8}$ in. high and consumes 500 watts.

The General Electric radiant grill may be used for frying, stewing, toasting, and broiling. This device consumes 600 watts.

Food Warmers.—Food warmers are made in a variety of portable styles, shapes, and sizes, and may be used on the table or sideboard.



Simplex Food Warmer.

Simplex nickel or silver plated food warmers of the following sizes and capacities are available:

Oval shape, 10 in. by 14 in.....	170 watts
Oblong shape,	
10 in. by 14 in.....	200 "
10 in. by 18 in.....	250 "
Oblong shape (extra heavy)	
10 in. by 14 in.....	200 "
10 in. by 18 in.....	250 "
10 in. by 26 in.....	400 "

STANDARD ELECTRICAL SPECIFICATIONS.

BY H. CONGER BOWERS.

(These specifications were prepared for the use of the Southern California Electrical Contractors' and Dealers' Association and the Los Angeles architects, for both of whom the author is acting as consulting electrical engineer. They are suggestive for use elsewhere. The general introductory provisions regarding business relations between the contractor and the architect have been omitted.—The Editor.)

General.—The work to be done consists in providing all materials, appliances, equipments, tools, labor, etc., unless otherwise stipulated, and the installation of certain electrical systems for power, heating, lighting, telephones and bells in the owner's premises, comprising three buildings, connecting pergolas, garage and yard, situate at..... in Los Angeles, California, all to be as herein described and in accordance with the contract documents.

All wires, except as may be hereinafter specified, shall be run in approved rigid galvanized or sherardized conduits.

Circuits of different systems must not be run in same conduit, but with the exception of service wires, two or more circuits of the same system may be pulled in the same conduit: Provided the fuses of the largest wire or any circuit will protect the smallest wire as specified in Code Rule No. 18.

The contractor shall furnish and have built in all necessary supports for conduits and boxes.

All condnts, junction boxes, outlet boxes, etc., must be properly concealed while the building is in the course of construction, as no cutting will be allowed except by permission of the architect.

Power System.—The system of wiring for power shall be for 220-volt, 3-wire, 3-phase, and shall consist of a separate and complete system of conduits, boxes, wires and appliances from the main switchboard to each and every power, or control outlet shown on plans or herein specified, inclusive of all equipment and appliances herein provided for.

Service to be as hereinafter specified.

Feeders to be as hereinafter specified.

Conductors in power circuits shall be of such size that the drop in potential will not exceed one per cent with full connected load.

Heating System.—The system of wiring for heating will be for 110-220-volt, 3-wire for feeders and sub-feeders, and 110-volt, 2-wire distributing circuits, unless otherwise specified, and shall consist of a separate and complete system of conduits, boxes, wires and appliances from the main switchboard to each and every outlet shown on plans or hereinafter specified inclusive of all equipment and appliances herein provided for.

Service to be as hereinafter specified.

Feeders to be as hereinafter specified.

Heating circuits shall be of such size, that the drop in potential will not exceed one per cent with the full connected load.

Lighting System.—The system of wiring for lighting will be for 110-220-volt, 3-wire for feeders and sub-feeders, and 110-volt, 2-wire distributing circuit and shall consist of a separate and complete system of conduits, boxes, wires and appliances, from the main switchboard to each and every light, receptacle or switch outlet shown on plans or herein specified, inclusive of all equipment and appliances herein provided for.

Service to be as hereinafter specified.

Feeders to be as hereinafter specified.

Lamp or distributing circuits shall be of such size that the drop in potential will not exceed one per cent, with the full connected load.

All lamp circuits shall be so arranged that not more than 16 sockets or receptacles, requiring not more than 660 watts shall be dependent on any one cutout.

Telephone System.—The wiring for telephone shall consist of a separate and complete system of conduits, cables,

wires and appliances connecting each and every telephone outlet shown on plans or herein specified, inclusive of all instruments, appliances and equipment shown or herein provided for.

Size of conduits, cables and wires shall be as herein specified.

Bell System.—The wiring for bells shall consist of a separate and complete system of conduits, boxes, wires and appliances, connecting the source of electric supply to each and every outlet shown on plans or hereinafter specified, inclusive of all battery, equipment and appliances herein provided for.

Underground Work.—All exterior work shall be run underground in approved galvanized rigid conduit, as hereinbefore specified, at least 18 inches below the finished surface.

Conduits shall be installed with leaded joints, shall terminate in the proper condulets or outlet fittings, which shall be closed to prevent the entrance of moisture of any foreign substance.

The conduit shall be given a coat of asphaltum paint or tar applied hot.

Conductors for power, lighting or heating circuits, shall be a standard 600-volt cambric insulated lead covered cable.

Telephone conductors shall be a standard double silk and cotton insulated braided and lead covered switchboard cable, having the required number of conductors and at least two extra pair.

The conductors shall be of the size hereinafter specified and shall be continuous from outlet to outlet, as no joints or splices will be permitted in the conduit.

The ends of cables must be impregnated with compound to prevent the absorption of moisture, must be properly served with rubber and cotton tape and well painted.

Telephone or bell wires must not be run in the same conduit with lighting or power wires.

Symbols and Location of Outlets.—The various outlets are indicated on plans by N. E. C. A. symbols, and indicate the approximate location of outlets only.

Figures in power outlet symbols indicate the number of horsepower for which the outlet is to be wired.

Figures in heating outlet symbols indicate the wattage for which the outlet is to be wired.

Figures in lighting outlet symbols indicate the number of 40 watt lamps.

Light outlets not marked, unless otherwise specified, shall be wired for 120 watts.

The contractor shall obtain from the architect the exact location of all outlets and exact height of all brackets, receptacles and switch outlets.

Service.—From the cross arm on lighting company's pole to the main switchboard, this contractor shall run underground, in the manner herein described, a four wire service.

This service to be a standard 600-volt, 4-conductor cambric insulated and lead covered cable having a 3/32x3/32 varnished insulation and 3/32 lead sheath.

Conductors in this cable to be No. — B. & S. G. stranded.

Cable shall terminate at either end in a standard 600-volt open air terminal.

This contractor shall figure on a distance of 100 ft. from the exterior wall of building to base of pole as measured along the ditch and he shall state in his bid the amount per lineal foot installed, to be added or deducted, should this distance be over or under 100 ft., the exact location of pole to be obtained before cable is ordered.

Main Switchboard.—The main switchboard to be furnished and erected in engine room by this contractor, shall consist of a blue Vermont marble panel of ample size to accommodate the switches and equipment hereinafter specified.

Marble to be of good quality, free from mineral veins, not less than 1½ inches thick, with ¾ inch bevel edges and polished face, bevel and edges.

or gap around the edge or sides. When the surface at any outlet is broken it must be repaired so as to leave no holes or open spaces at outlets.

Light outlet boxes shall be a standard 4 inch box fitted with plaster ring and must be provided with an approved stem or stud threaded for $\frac{3}{8}$ inch standard pipe. This stem must be securely fastened to box by at least four bolts, and should enter box from back.

Should the contractor use a box larger than the standard 4 inch round box, it must be provided with a cover and this cover must be provided with lugs taped for screw threads.

Flush Switches.—Furnish and install, where shown on drawings, or hereinafter specified, "H. & H.," "Perkins," "G. E.," "Cutler-Hammer," "Arrow E," flush push button type switches, of the best grade of their respective make, competition switches will not be accepted, to control lights as indicated on plans. Plates must be of brass, finished to match hardware and not less than 60 mils in thickness.

Where more than one switch comes in the same location they shall be provided with gang plates, and plate must be engraved to show lights controlled. All switches and plates must be set flush and true with wall and trim.

Receptacles.—Furnish and install where shown on lighting plans or herein specified, Edison screw plug double hinged door type flush receptacles. All lighting receptacles, unless otherwise shown, to be wired for 120 watts each.

At each heating outlet shown or herein specified provide a 25 amp. flush receptacle, either double pole or triple pole as indicated and each wired on a separate circuit of not smaller than No. 8 B. & S. G. wire.

Receptacles for iron where indicated, to be of the indicating type, indicator to burn only when plug is inserted, and each to be wired on a circuit of not smaller than No. 12 B. & S. G. wire.

All receptacles to be provided with brass plates, not less than 60 mils in thickness and finished to match hardware. Receptacles and plates must be set flush and true with wall and trim.

Knife Switches.—All knife switches called for herein to be of the best grade, polished, and only such switches may be used as are listed and approved by the Southern California Chapter, American Institute of Architects.

Fuses.—Provide one complete set of fuses.

Fuses on panel board to be of the plug type, and on switch-board to be of enclosed type as provided in Code Rule 68-F.

Only such fuses may be used as are listed and approved by the Southern California Chapter, American Institute of Architects.

Motor Circuits.—From the power panel board to the various locations shown on plans, this contractor shall run 220-volt, 3-wire, 3-phase motor circuit to the following motors:

One 1 h.p. for boiler.

One 5 h.p. for vacuum cleaner.

Two 3 h.p. in laundry.

At each of these motors, except vacuum cleaner, this contractor shall install one enclosed type 3-pole, fused knife switch for motor control. From this knife switch this contractor shall install conduits and wires and make motor connections.

Vacuum Cleaner Motor and Control.—Provide at location of vacuum cleaner motor in basement a Hart or G. E. remote control switch and operate from combination momentary contact switch and bulls eye receptacles placed at each cleaner outlet marked "V. C." on plans.

Do all wiring and furnish all electrical material in connection with the vacuum cleaner motor and above switches, using the same grade of material as specified above and taking motor circuit from power panel board.

Telephones.—Provide all material and equipment and install an inter-communicating telephone system, consisting of

seven selective ringing, selective talking, automatic, non-interfering telephone sets, each to be fully equipped and wired, each set to be provided with a retardation coil of high impedance and of at least 100 ohms resistance and the bells, transmitters, and receivers to be of the high resistance type.

Telephone circuits to be full metallic and number of conductors to be as required.

Telephones to be located where shown on plans and type of set to be as indicated.

All conductors must be continuous from outlet to outlet as no splices or joints of any description will be allowed, except in outlet or terminal boxes.

All connections in the cables or between rubber covered wire and cable shall be made by means of soldered terminal strips enclosed in proper size boxes. The wires leading to the terminals must be properly formed and taped or laced and ends of cables thoroughly saturated with compound to prevent the absorption of moisture. These terminal strips may be placed in the telephone outlet box, using the telephone for cover, in which case a sufficient length of flexible wire must be used to permit the telephone being moved without disconnecting. Splices may be made in the rubber covered wire without the use of terminal strips, providing there are not to exceed five pairs in the box where splice is made.

Conduit sizes to be in accordance with the N. E. C. A. conduit chart.

Boxes shall be provided at all outlets and must be large enough to prevent crowding of wires and cables.

Provide and properly connect the necessary dry cell battery to operate the system in a satisfactory manner. Battery to be enclosed in a neat battery box and located in basement where shown.

Bells.—This contractor will provide all materials and equipment and install a complete call bell system, consisting of a 10-drop flush wall type automatic reset annunciator and the buzzers and push buttons shown on plans or herein specified.

System to be fully wired and annunciator drops connected to operate from push buttons shown.

Provide in each dining room a floor push, located as directed and connected to operate buzzers in kitchen.

Push button at all exterior doors to match in design, finish and workmanship door hardware. Interior push buttons to be of cast brass or bronze, design and finish to be selected by the architect.

Bells or buzzers in the same general location must be of decidedly different tone and all bells and buzzers must be of the best grade and equipped with spiral spring and screw adjustment.

Annunciator to be metal front flush type, finish as selected and to be of an approved make.

Provide and place in telephone battery box sufficient dry cell battery to operate system in satisfactory manner.

ELECTRIC APPLIANCES GAIN FAVOR IN VENEZUELA.

On account of the fact that coal is not now obtainable here at a reasonable price, and that wood fuel is uncertain—it is almost impossible to cut it during the rainy season—the owners of saw-mills, grist mills, hat factories, bakeries, pumping establishments and numerous other small industries have shown increasing interest in electric power and heating devices since the electric company decided to supply power during the day. There is a good opening for all kinds of electrical appliances for domestic and industrial use, such as fans, stoves, irons, large ovens for bakeries, motor-driven pumping outfits for private houses, motors of 1 to 25 h.p., etc.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

In December the great Canadian Pacific railroad tunnel under the Selkirks in the Rockies will be open for service. The project, when finished, will have cost twelve million dollars.

* * *

In a recent copper ore test of a new electric smelter at St. John's, Newfoundland, a high grade of copper was produced. The plant has a capacity of about 1000 pounds of ore per hour.

* * *

Theatrical cream is said to be a boon to the wiremen or anyone who has to handle wire with black, sticky insulation. Many electricians use gasoline, washing powder, etc., which commonly results in chapped and sore hands.

* * *

The manufacture of dyes from the waste of Osage orange wood to the extent of seven hundred and fifty thousand dollars' worth a year is now carried on in the United States. This should be an electrical industry of the West rather than of the East as it is at present.

* * *

Jovianism at the recent Indianapolis convention received an unprecedented further awakening. With Henry L. Doherty as Reigning Jupiter and an enthusiastic membership of over nineteen thousand strong backing him great things are anticipated for the near future.

* * *

During last July it is estimated that ten miles of ships passed through the Panama Canal. In all, there were one hundred and forty-nine ships. The Siberia and Korea, familiar to Pacific Coast cities, possessed the greatest length, each being five hundred and fifty-two feet long.

* * *

The recently patented electrical ticket selling machines for the movies, now so popular in America seem to have no future in Russia. This is due to the fact that regulations for collecting internal revenue in that country necessitate the issuance of ticket stub books to theatre managers by the local governmental authorities.

* * *

Perhaps no subject has received greater engineering discussion than that of a tunnel under the English channel. It is now proposed by a distinguished English engineer that the tunnel be constructed in two tubes at a depth in the chalk bottom of the channel of one hundred and fifty feet below the channel bottom. It is estimated six years will be necessary in its completion.

* * *

A question which is of great interest to many municipalities is the extent to which some form of motor bus can be used to supplement the existing street car service; in outlying districts, for instance, which it is desired to connect with the existing lines,

but where it is not practicable to build expensive extensions under present conditions.

* * *

A cyclo-harmonograph, an instrument for drawing a large class of curves in higher mathematics, has just been invented by the professor of mathematics at the University of Washington. It is expected that the instrument will find a wide application among designers and architects as it draws a great variety of rosettes and foliate curves.

* * *

Electricity has been making great strides in India. Local electric works advertise to furnish current not only for lighting but for mechanical uses. A big future is seen in the domain of the small engine. These engines are especially employed at present in the grinding of flour made of wheat and millet of which the native chapatties or cakes are made.

* * *

Gramophone records are now being made which reproduce the Morse signals as they appear in the microphone of a wireless receiver. These records commence with the simple Morse code and pass on to dummy messages, including figures, fractions, stock exchange terms, and other items of importance in the commercial and financial world.

* * *

Investigations in rate-fixing of public utilities have brought to light the interesting fact that the cost per unit output of steam and electrical machinery of given speed decreases as the capacity increases. In considering the depreciation of this equipment, on the other hand, the inverse is found to be true; namely, the depreciation increases with the capacity.

* * *

The diversity factor of electric cooking has been found to be about 1 to 7, though it is considered safe practice to figure on a ratio of 1 to 10, as the maximum demand of the cooking load seldom occurs at this time of the station peak. This permits the installation of at least seven times as many ranges on a distributing system as the connected load would seem to indicate.

* * *

With the rapid shortening of the days, the electric expedient of a Cincinnati poultry man will appeal to others interested in the business. At five each morning the inventor turns an electric switch in his bedroom and the hen house is flooded with brilliant illumination. The inmates, under the impression that dawn has broken suddenly though unaccountably, proceed to the day's activities, with the result that appreciable headway has been gained by the time neighboring roosts awaken. By five in the afternoon, when day starts waning, the same thing is repeated. For two hours, more or less, these hens continue to scratch and lay while their neighbors are perched in dreamland. The eggs produced equal in number the record of the longest days in summer.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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The all-steel, electrically-driven Yuba No. 15, described on another page of this issue, marks again a definite advance in the art of gold dredging in the West.

Electrical Operation of Gold Dredges

The construction of the first gold dredge in California in 1898 heralded the beginning of a new era in gold mining. Since that period the rapid advances made in gold dredging and the gradual increase of gold output in that commonwealth have gone hand in hand with improvements and enlarged construction in gold dredges. As a consequence the fifty-eight operating dredges in the gold-bearing districts of that region make the California gold dredge today the model after which other countries pattern.

In this period of less than two decades the gold dredge has evolved from the steam-shovel-placed-on-a-raft idea to the giant steel clad monster of the Yuba No. 15 type, that scoops up 300,000 cubic yards of gold-bearing gravel each month, while operating to a depth of 84 ft. beneath the surface.

It is interesting to note, too, that electricity is playing an ever widening importance in the operation of the gold dredge. The earlier type of dredge boasted but some hundred and fifty horsepower of installed capacity, while this most recent creation has an installed capacity of over one thousand horsepower.

But the most remarkable advance is to be found in the manner in which the electrical equipment is installed upon the dredge.

Some two years ago the installation of Yuba No. 14, at that time the most powerful and well equipped dredge in existence, utilized a motor of four hundred horsepower as the main drive. The contactor equipment was provided with inverse time limit overload control for alternating current operation. Since the installation of this dredge, however, it has been found that certain fluctuations are felt on the alternating current operated control due to the unevenness of operation of the digging motor. This condition of affairs is entirely avoided on the Yuba No. 15 by having the contactor control for the 500 h.p. main drive motor operated by direct current from a motor generator set installed on the boat.

Other things that commend themselves in the design are the safety features that have been carefully worked out. The switchboard fronts are practically "dead front" in every particular.

Thus throughout the entire work the first idea has been not only to attain increased efficiency in operation but also to protect the operator as far as is reasonably possible from coming in contact with the live parts.

A gold dredge is in actual operation between 85 and 88 per cent of the total time, since the dredge operates night and day with three shifts. The load factor varies from 62 per cent to 80 per cent, depending on the character of ground.

California has since the days of 1848 produced almost one and two-thirds billions of dollars in gold. Last year over one-third of her entire gold output came from the fifty-eight dredges operating within her confines. The increased economy in dredge operation under high class design means much to the future of this activity in the West. At the same time this ever increasing load for the hydroelectric companies of the West

from this source means a continued prosperity for hydro-electric enterprises.

One of the chief needs of the electrical contractor has been closer co-operation with the architect. The architect is the planner, the contractor the doer. Upon their co-ordinated efforts depends the satisfaction of the owner. Heretofore both contractor and architect have been too far apart in their ideas to insure that the owner will also be pleased.

Standard Specifications

In the first place, it is a lamentable fact that the electrical equipment is too often the first to be curtailed when consideration is given to cutting the cost of a proposed building. The number of outlets is minimized, baseboard receptacles are omitted and adequate provision for electrical conveniences is neglected. As a result the average house has barely enough lighting fixtures, and no opportunity for utilizing electric heat and power in the home or office. Considering the well-nigh universal use of the electric iron, the large number of washing machines and vacuum cleaners and the serious limitations of lamp-socket circuits on all heating appliances, it is high time to wire every home for electric heat and power utilization as well as for lighting.

Then, again, even when the architect provides for these electrical conveniences, he is sometimes at a loss in preparing the specifications. With so many highly specialized branches of construction—mechanical, electrical and sanitary—it is too much to expect an architect to be an expert in every line. The specifications are therefore frequently hazy regarding important details and their interpretation causes needless friction.

For the contractor to furnish specifications is an unfair burden for him to bear, and likely to prove unsatisfactory to the owner.

The first step in the solution of this problem is for the architect to employ an electrical engineer to prepare the specifications. The architect thus protects his reputation and his client, the contractor is enabled to make an intelligent bid and the owner is assured a good job.

But, as time goes on, it is found that many jobs are so similar that only minor changes are necessary to adapt the specifications for one installation to another. It becomes possible to use standard specifications.

Recognizing this fact, several manufacturers have served the architect by supplying him with specifications to meet required conditions. But because of the suspicion that certain makes of material will be specified to the exclusion of other meritorious brands, this practice does not always meet with favor.

Consequently the standard specifications prepared for the use of Los Angeles contractors and architects by Mr. H. Conger Bowers, as printed elsewhere in these columns, is of considerable interest and value. They allow a wide latitude in the choice of approved materials. Emphasis is placed upon quality rather than upon the manufacturer. The architect is greatly assisted by their use and every branch of the industry is benefited.

The past week has seen the inauguration of a public-spirited movement in one of the cities of the West that cannot fail in bringing forth the hearty commendation of all the well-wishers of this growing section of our country. Reference is made to the launching, through private guarantees, of a San Francisco Bureau of Governmental Research. Thus far the movement has received the full endorsement of the mayor of the city and it is backed financially to the extent of one hundred thousand dollars in pledges. It is organized to be active for at least a period of five years. The names of the men back of this enterprise are in themselves sufficient guarantee that the founding of this research bureau will be on the broadest lines possible.

Economic and unified government in American cities is the appalling need of the hour. So complex has grown the running of municipal affairs and to such enormous proportions has become the annual budget outlay that the coming to light of gross misjudgment in such matters, often involving hundreds of thousands of dollars in expenditure, is almost a matter of daily occurrence in some city of America.

Since city funds are in a large measure spent in the construction of municipal enterprises, such as fire protection, water supply, or lighting and power development, the engineering features of municipal effort too often prove biased in judgment and lacking in harmonious, unified design.

Of all the problems that confront a municipality, that of economic development of its engineering features are by far the most important. If ever a judgment absolutely freed from political influence is needed, surely in the solution of these problems its need is paramount.

That a beginning is to be made in a Western city looking toward the solution of municipal problems by means of a privately endowed bureau of research is indeed a source of congratulation. The movement deserves the moral support of all who are interested in the evolution of clean, economic city government.

And, too, this movement should go further than the confines of a municipality. In California, alone, the issuance of state, county and municipal bonds now totals almost a quarter of a billion dollars. This means that the citizens of this commonwealth have to meet in interest charges alone an annual outlay of ten million dollars. Conservative bankers estimate that in less than a decade this bonded indebtedness will probably be twice its present enormous totals.

It is high time, then, that citizens of the various commonwealths of the West should be seriously devising means whereby the truth may be freely and impartially searched out in civic problems of city, county and commonwealth. Of course, it goes without saying that those employed in such work should be of the highest fitness in attainments and in every way free to give the matter the most painstaking and searching investigation, independent of any undue private, public or political influence.

It is believed that the ethics of the West are pure enough in their conception to attain this ideal, and no stone should be left unturned to arouse the public conscience to the necessity of research in every department of Western civic activity.

PERSONALS

F. G. Baum, consulting engineer at San Francisco, is in New York City.

Carl Stradley, chief engineer of the Oregon Short Line Railroad, was a recent visitor at San Francisco.

W. D'A. Ryan, lighting expert of the General Electric Company, and **A. F. Dickerson**, his assistant, are at Los Angeles.

E. B. Strong, president of the Technical Publishing Company, has returned from an extended business trip throughout the East.

E. B. Walthall, assistant general manager San Joaquin Light & Power Corporation, has returned to Fresno, Cal., from San Francisco.

H. H. Hughes, sales engineer Westinghouse Electric & Manufacturing Company of Fresno, spent a few days this week at San Francisco.

R. D. Holabird of the Holabird-Reynolds Company, has returned to San Francisco from an extended business trip throughout the East.

W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company, has returned to San Francisco from an extended Eastern trip.

George Sanford, manager of the Great Western Power Company at Rio Vista, was a business visitor at San Francisco during the week.

C. J. Thelen, with the Electric Railway & Manufacturers' Supply Company, is making a business trip throughout the northern part of California.

Adolph Sprauch, head of heating sales of the Pacific Gas & Electric Company, has returned to San Francisco after a short business trip to Newcastle.

G. Douglas Jones has resigned as electrical engineer with the California State Engineer's office, after six years' service, in order to enter business for himself.

D. E. Harris, who has been district sales manager of the Pacific States Electric Company for many years, has been elected a vice-president of that company.

S. H. Taylor, president of the Electric Railway & Manufacturing Supply Company, expects to leave for an extended business trip throughout the East shortly.

Ellery A. Baker, vice-president and assistant general manager Rathbone, Sard & Co., manufacturers of electric ranges, was at San Francisco during the past week.

H. H. Hoxie, sales manager of the Electric Railway & Manufacturers' Supply Company, has returned to San Francisco from a ten days trip to Los Angeles and the Southwest.

E. K. Johnson, formerly with the Pacific States Electric Company, has recently joined the sales force of the Electric Railway & Manufacturers' Supply Company of San Francisco.

H. P. Pitts, commercial engineer Pacific Gas & Electric Company, left San Francisco this week to attend the convention of the National Commercial Gas Association at Atlantic City.

B. J. Klein, Pacific Coast representative of the Bristol Company, of Waterbury, Conn., will return from an extended trip throughout the Pacific Northwest about the last of next week.

Henry F. Holland, formerly Pacific Coast manager of the Simplex Electric Heating Company, has recently been appointed heating specialist for the Great Western Power Company at San Francisco.

Max Thelen, president of the California Railroad Commission, and Commissioner Edwin O. Edgerton, are attending the twenty-eighth annual convention of the National Association of Railway Commissioners at Washington, D. C.

MEETING NOTICES.

San Francisco Development and Jovian League.

R. F. Behan, "assistant to the Westinghouse Company," was chairman of the day at the November 1st meeting. After **T. E. Bibbins** and **N. J. Pendegast** had spoken briefly on some of the amendments to be voted on at the coming election and **A. H. Halloran** had explained the advantage of local advertising during America's Electrical Week, Mr. Behan in a few well-chosen words introduced **Dr. I. M. Rubinow** of the Social Insurance Commission as speaker of the day. As at a previous meeting the subject of social insurance had been subject to vigorous attack by **Dr. Marsh**. **Dr. Rubinow** spoke in its defense. He particularly urged its adoption as a substitute for present day charity methods in caring for sickness. He briefly traced its early foreign history and told of the success of the plan in Liepsic and other cities on the continent. He mentioned the augmented interest in the subject in this country and stated that the problem is one which must be solved jointly by industry and general society. Upon industry he placed the responsibility for much of the sickness of working people and consequently the burden of its alleviation. The speaker stated that social insurance had been in operation for 35 years in Europe and that it was not too late for California to take the step.

Los Angeles Jovian Electric League.

A highly interesting and instructive lecture, illustrated with lantern slides, was delivered at the luncheon November 1st by **A. A. Schmidt** and **E. R. Wolcott**, representatives of the Western Precipitation Company. Their subject, "Commercial Use of Electricity as Applied to Precipitation," highly technical and covering a subject little understood by the average individual—deals with the removal of suspended particles from gases by the use of high-potential electrical discharges, resulting in the abatement of smoke fumes and dust, and conserving the particles collected, which are used as by-products for fertilizer, etc. Mr. Schmidt stated that the precipitation process is rapidly finding favor with the larger chemical and metallurgical works, cement mills, and smelters throughout the country, and he stated further that in one plant alone 90 to 100 tons of dust per 24 hours are collected and used as potash fertilizer. **H. B. Woodill** introduced **Mr. E. P. Judah**, president of the Merchants' & Manufacturers' Association, who gave a short and interesting talk, and he was followed by the reading of a letter from **Thomas A. Edison**, acknowledging the greetings extended by the Jovian League. On motion of **James Colkitt**, it was voted to send a letter of greeting with the best wishes of the league to **Murray Orrick**, of San Francisco, the new Statesman for California. First Tribune **Harry N. Sessions** then announced a rejuvenation to be held December 8th.

At a business meeting held previous to the regular meeting, the following were appointed on the membership committee by President Morphy. **Harry N. Sessions**, chairman; **K. E. Van Kuran**, **J. O. Case**, **W. J. Barman**, **I. R. Solomon**, **C. T. Carr**, **C. E. Cayot**, **A. B. Day**, **R. L. DeCamp**, **H. P. Hubbard**, **James Irvine**, **J. A. Rogan**, **F. B. Nightingale**, **F. J. Royer**, **E. Woodbury**, **George A. Vedder**, **Fred Lasher**.

H. H. Fogwell, of the Westinghouse Electric & Manufacturing Company, as chairman of the day, furnished the program.

TRADE NOTES.

The domestic science department of the Oregon Normal School at Monmouth, Ore., will install a complete outfit of electric cooking appliances. A rock crusher operated by the city of Dallas has been moved from an outlying point into the city. It will be served electrically by the Oregon Power Company. The High School at Independence has installed a 3 h.p. ventilating fan motor.

Western States Gas & Electric Company of Stockton, Cal., has secured a contract with the Samson Sieve-Grip Tractor Company for electric energy to operate a $\frac{3}{4}$ -ton electric furnace. This is the second electric furnace installation in that city, the first being installed several months ago at the Monarch Foundry Company, which is also served by the Western States Company. Other new business recently secured by the Stockton division includes a larger power installation for the operation of the gold dredger for the Natomas Company, which sank its pond in the spring.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Commission has approved the merger of the Home Telephone Company of Los Angeles with the Pacific Telephone & Telegraph Company.

Coast Counties Gas & Electric Company has filed a complaint, stating that the Sierra & San Francisco Power Company is encroaching on its territory by constructing lines preparatory to distributing electric energy to the Old Mission Portland Cement Company, in the neighborhood of San Juan Bautista, San Benito county.

Attorney William Simmons, representing minority stockholders of the Central California Gas Company, of which C. S. S. Forney is president, has asked Commissioner Gordon to have the accounts of the gas company investigated before the commission passed upon the application of the company for authority to issue \$87,000 of prior preferred stock. Commissioner Gordon asked Simmons if he wanted the commission to allow the company to go into receivership, which would be the case if the commission should refuse to permit of financing necessary to pay \$12,000 on bond interest. Simmons replied that he did not believe a receivership was necessary. The application was submitted for the consideration of the commission.

The H. G. Lacey Company and the Mount Whitney Power & Electric Company has filed with the Railroad Commission a joint application for authority for the Lacey Company to sell its electric plant and system at Hanford, Kings county, to the Mount Whitney Company for \$150,000.

F. Hammond, complainant against the Tujunga Water & Power Company of Los Angeles county, has asked the commission for a rehearing of its decision which dismissed his original complaint. Hammond wants the company to furnish him with irrigating water, which he says the company refuses on the ground of inadequate supply. He says the company has plenty of water, and that if it will not furnish the water that the commission should order it put into the hands of a receiver.

NEWS OF CALIFORNIA WATER COMMISSION.

E. W. Pereira of Ft. Jones has applied for permission to appropriate 125 cu. ft. per second of the waters of Scott River, tributary to the Klamath River, in Siskiyou County, for agricultural purposes. There is a proposed main canal 7 miles long and a cement dam 8 ft. high, 60 ft. on top and 35 ft. on bottom, the works to cost, as estimated, \$48,500. Ten thousand acres are sought to be brought under the ditches.

J. F. Carney of Montgomery Creek, Shasta County, has applied for permission to appropriate for agricultural purposes five cu. ft. per second of the waters of Hatchet Creek, tributary to Pit River, in the above county. A main ditch 4 miles long is proposed to convey the water to 200 acres at an estimated cost of \$1000.

Arnold J. Claussen of Alturas has applied for permission to appropriate 560 acre feet per annum of the water of Portage Flat drainage area and Canyon Creek, tributary to Pit River, for irrigation purposes. There is proposed a main ditch $2\frac{1}{2}$ miles long to water 127 acres at an estimated cost of \$1000.

UNIVERSITY EXTENSION COURSES IN ELECTRICITY AND CHEMISTRY.

University extension courses in electricity and chemistry were inaugurated in San Francisco at the Polytechnic High School, Frederick street, near First avenue, on Friday evening, November 3d. This is a new opportunity for those interested in taking these subjects and its inauguration should be welcomed by a large enrollment.

NEW CATALOGUES.

Wm. B. Scaife & Sons Company of Pittsburgh has just issued a booklet of thirty-two pages on filtration. The publication deals with water purification.

"Melting Aluminum Chips" is the subject matter of Bulletin 108 just issued by the U. S. Bureau of Mines. "The Use of Mud-Laden Fluid in Oil and Gas Wells" is likewise the subject matter for Bulletin 134.

"The Wire Message" is a new monthly house organ published for free distribution by Habirshaw Electric Cable Company, Inc., and The Electric Cable Company, 10 East Forty-third street, New York. Its purpose is to present timely information regarding the wire and cable trade.

"Your Christmas Campaign From Westinghouse" is the subject of a large folder and accompanying literature being supplied to electrical dealers by the Westinghouse Electric & Manufacturing Company. The folder reproduces four pages to appear in the Saturday Evening Post during November and December, and illustrates and describes various means for tying in locally with the national campaign. These include a Christmas folder to be mailed to consumers, street-car cards, the billboard posters, window cutout, window cards and lantern slides.

The Cutler-Hammer Manufacturing Company of Milwaukee has just distributed to the electrical trade a large broadside devoted to the publicity campaign on the C-H push socket. This broadside shows an illustration of a large display cutout, which is given free to electrical dealers and contractors. It also contains reproductions from pages of the various publications in which advertisements are being carried, which include the Saturday Evening Post, Literary Digest, Factory, and the electrical papers. The big display in this broadside shows a series of nine advertisements which are carrying the message about the C-H push socket to thousands of homes, factories and the entire electrical industry. The broadside points out some of the advantages of the push type sockets of 660 watts capacity.

"Magnetic Switch Control Apparatus" is the title of the new booklet M published by the Cutler-Hammer Manufacturing Company of Milwaukee, describing alternating and direct current types of magnetic switch control apparatus. In this 32-page booklet there are 79 illustrations showing the apparatus as well as installation of this apparatus. The systems of automatic or magnetic switch types of control are clearly explained. Among other subjects a complete description of the new magnetic lockout switch is included. In the alternating current section air brake and oil brake types of switches are shown and described. This booklet should be of considerable value to all interested in industrial applications.

BOOK REVIEW.

How to Make Low Pressure Transformers. By F. E. Austin. Size 5x8 in.; 24 pp.; 16 illustrations; cloth binding. Published by F. E. Austin of Hanover, N. H., and for sale at the Technical Book Shop, San Francisco. Price, 40 cents.

This is the third edition of this little booklet written by Professor Austin. Its written matter well carries out the title of the work, and the booklet should continue to have the popularity it has hitherto enjoyed.



NEWS NOTES



INCORPORATIONS.

LONG BEACH, CAL.—The Molander Power Company has been incorporated for \$1,000,000. Officers of the company, having headquarters here, are: H. P. Molander, president; J. E. Craddick, first vice-president; W. B. Weiss, second vice-president, and E. A. Wilson, secretary-treasurer. Work has been started on the end of Long Beach pleasure pier for the construction of a \$25,000 plant for the company, which is to produce electric power from wave motor equipment.

ILLUMINATION.

SPARKS, NEV.—Plans for putting in street lights on B street are being considered by the city council.

NEWPORT, CAL.—The city trustees have instructed the electrician to install twelve street lights on Balboa Island at a cost of \$196.

DOUGLAS, ARIZ.—Three complaints have been presented to the city council on the proposed assessment of the G avenue lighting system.

VISALIA, CAL.—The trustees have passed a resolution declaring it their purpose to call for bids for an electroliner system on West Main street.

CLE ELUM, WASH.—South Cle Elum has awarded the contract for its new electric lighting system to C. H. E. Williams, Seattle, at \$4070.

BOISE, IDAHO.—The Idaho Power Company has been granted permission by the public utilities commission to construct and operate an electric light system in Filer.

TACOMA, WASH.—An ordinance has been passed by the council providing for the purchase of incandescent electric lamps to the value of \$20,000, and making an appropriation therefor.

ANCHORAGE, ALASKA.—It is announced that the lighting plant authorized by Chairman Edes of the Alaskan Engineering Commission will be in operation by the first of January, 1917.

LOS ANGELES, CAL.—At a meeting of the Mount Washington Improvement Association the installation of ornamental lighting posts along the road up Mt. Washington was advocated and work will begin soon.

PORT ANGELES, WASH.—The city council has laid over the awarding of the contract for electrical supplies for the city light extensions until progress is made in the completion of the sale of the \$25,000 bond issue.

BOZEMAN, MONT.—R. W. Leslie of Chicago, has made application to the city council of this city for a franchise to supply the city with gas. He proposes to spend \$150,000 in putting up a plant and laying 12 miles of mains.

PORTLAND, ORE.—Electric light fixtures on the interstate bridge will cost \$11,724. The contract has been let to the Pacific States Electric Company and the United States Products Company for posts, brackets, wiring and copper conduits, transformers and time switches.

LOS ANGELES, CAL.—An ordinance has been adopted by the city council for the installation and maintenance of the necessary Marbelite centrifugally made reinforced concrete ornamental lighting posts and appliances for the lighting of 55th street, between Budlong avenue to Normandie avenue.

LOS ANGELES, CAL.—Walter D'Arcy Ryan, illumination engineer, is in Los Angeles to design a system of illumination for the main business streets of the city. He is accompanied by A. F. Dickerson and their staff will at once begin planning for the first unit of the system which will be installed on Broadway between First and Tenth streets.

POCATELLO, IDAHO.—The committee, appointed from the council to investigate the proposition of Joseph Burns, in regard to the installation of a municipal light plant, reported at a recent council meeting that the members had visited the proposed site and found it feasible for a power plant to furnish the city with 200 kilowatts daily.

TRANSMISSION.

MARSHFIELD, ORE.—The Eastside city council has granted the Oregon Power Company an electric franchise for 25 years.

BOISE, IDAHO.—The Mackay Light & Power Company has written the public utilities commission regarding plans for the extension of its service to Pioneer.

BREMERTON, WASH.—Plans and specifications have been prepared for the new power line connecting the navy yard and Keyport by telephone. The cost will be about \$10,000.

EASTSIDE, ORE.—The Oregon Power Company has been granted a 25 year franchise to supply current for both light and power. Extension of power lines to this place must begin in 60 days.

DAVENPORT, WASH.—The Washington Water Power Company of Spokane has petitioned the commissioners for a franchise to construct a transmission line over certain roads in Lincoln county.

EVERETT, WASH.—The Snohomish county commissioners granted a franchise to the Washington Utilities Company for the construction of light and power lines from Norman to Florence, thence to Stanwood.

ST. ANTHONY, IDAHO.—It is reported that work will soon begin on the construction of an electric line between Ashton and Preston, connecting with the electric road at the latter place. The Pocatello Traction Company will construct the road.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company and subsidiary companies propose to spend \$1,215,000 for reconstruction and extension work the coming year. This will include track and trestle work, paving, overhead service, light and power plants and other work.

EVERETT, WASH.—The county commissioners have signed the franchise giving the Washington Utilities Company the right to construct an electric power line along the road running from Norman through Florence to Stanwood. The Utilities Company recently took over the holdings of the Jim Creek Water, Light & Power Company. The work will cost about \$15,000.

RIALTO, CAL.—Work on the construction of a power plant to supply Fontana and Rialto with electrical energy and four and a half mile pipe line to the plant from Lytle Creek will start at once, it is announced. The work will be done under the direction of McMeen & Miller, Chicago engineers. The Western Pipe & Steel Company will furnish the pipe. The sum of \$375,000 will be expended on the work.

SAN LUIS OBISPO, CAL.—The Midland Counties Public Service Corporation is preparing to extend its power lines in various parts of this and Santa Barbara county. It is reported the parent company known as the San Joaquin Light & Power Company, has appropriated \$300,000 for additions to the service. Arrangements are reported to have been made for establishing a branch line to Avila and that later the towns of Morro, Caucos and Cambria will be supplied.

SEATTLE, WASH.—The purchase of a completely developed power plant at a cost not to exceed \$3,000,000 is proposed under the terms of an ordinance introduced at a recent meeting of the city council. The plant is desired to supple-

ment the present power plant at Cedar River. Construction of an additional unit to the steam auxiliary plant on Lake Union is also contemplated by the utilities committee. This addition will cost between \$300,000 and \$400,000. The present plant capacity will be doubled.

SPOKANE, WASH.—Hugh L. Cooper of New York, the engineer who constructed the Keokuk dam across the Mississippi and is head of the \$6,000,000 Z Canyon hydroelectric project near Spokane, recently visited Chelan, according to report. The dam is to be constructed on the Chelan River and is to be 170 ft. high. The maximum capacity of the hydroelectric plant to be erected will be 120 000 h.p. and work to be started April 1, 1917. It is proposed to furnish electric power to the district between Winesap and the Okanogan country to be used for irrigation pumping. The Northern Pacific railway owns all the rights on the Chelan River three miles in extent with a fall of 300 ft. and owns other rights on Lake Chelan. It is working out plans for electrifying its line between Spokane and Seattle and may also electrify the line from Vancouver to Portland.

TELEPHONE AND TELEGRAPH.

KENNEWICK, WASH.—A 25-year franchise has been granted to A. F. Brown for construction of a telephone and telegraph system.

PASADENA, CAL.—The city of Pasadena has contributed \$300 in cash and \$200 in work for rebuilding the telephone line running the entire length of Arroyo Seco, a distance of seven miles.

EL CENTRO, CAL.—The Imperial Telephone System has moved from the little makeshift plant on Fifth street to its spacious new home on State street, between Sixth and Seventh which was erected at a cost of \$80,000.

GLOBE, ARIZ.—The district commercial manager of the Western Union Telegraph Company has decided that it will be necessary, in order to fully relieve the wire congestion here, for the company to install quadruplex equipment, and has made recommendations accordingly.

MODESTO, CAL.—The local exchange plans to expend \$10,000 for enlarging the telephone system. Plans have been received by Manager E. Garner, and call for three new lines from Modesto to Oakdale, Empire and Hughson. A 25-pair cable line will span Dry Creek. The open wire work on Needham avenue will be replaced with lead covered cable, 200 ft. beyond the city limits. The new construction will be under the supervision of J. F. Weitzenberg. The exchange facilities in the Modesto plant will be enlarged.

TRANSPORTATION.

LINDSAY, CAL.—Surveys have been made for a right of way for the Pacific Electric which plans to build its line into Lindsay.

IRRIGATION.

SACRAMENTO, CAL.—The Sacramento Realty Board will aid the Cosumnes property owners who want a water district formed to include approximately 30,000 acres. It is said that several of the largest property owners are opposed to the district.

DIXON, CAL.—Engineers Hawley, Whitney and Loveland in the employ of the State have reported on irrigation scheme to water 55,000 acres of land and save the output of Putah Creek which is now running to waste. Reservoir sites are under consideration at Devil's Gate and Guenoc, the costs of construction being \$7,000,000 and \$5,000,000 respectively.

TERRA BELLA, CAL.—The directors of the Terra Bella Irrigation District will receive sealed bids to November 13th

for the construction of an irrigation works for the district. The work to be done comprises the construction of 16 wells and well pumping plants, five main boosting pumping plants and approximately 49 miles of pipe lines.

PARADISE, CAL.—The Paradise Irrigation District of Butte County has applied for permission to appropriate 19,600 acre ft. by storage of flood waters of Butte Creek, to be used in the irrigation of the lands of the district. It is proposed to begin work in the summer of 1917 and complete it within two years. The estimated cost is \$350,000.

GLENN, CAL.—J. Overholtzer of Glenn has applied for permission to appropriate 60 cu. ft. per second of waters of the Sacramento River in Glenn county. The proposition is to divert the water by means of electrically driven pumps discharging into a main canal five miles in length. The estimated cost is \$15,000.

MONTAGUE, CAL.—A survey is being made of the Webb tract comprising 2000 acres for the purpose of determining the number of acres that can be covered from their pumping plant on the Shasta River. Recently the Webb Bros. made application to the State Water Commission for permission to appropriate 12 cubic feet per second of the waters of Shasta River for the purpose of irrigating this land.

SAN DIMAS, CAL.—Work has been started toward bringing water to the San Dimas Heights tract. Water will be brought by way of San Dimas canyon to a point near the Mountain Spring ranch, thence by gravity to the top of the hills where a large new reservoir will be constructed. The estimated cost of the project is \$1 500,000. The boring of a 6000 ft. tunnel will also be necessary.

OAKDALE, CAL.—Announcement of the Sierra and San Francisco Power Company for the construction of new reservoirs on the Stanislaus River will probably result in the re-opening of negotiations with the Oakdale Irrigation District for the use of the stored water, after it has once been used for developing power. The power company previously agreed to sell the stored water to the districts for \$1 per acre foot. This was considered too high by the irrigation board.

LLANO, CAL.—The Llano del Rio Company of Nevada, with headquarters at Llano, Los Angeles county, has applied to the state water commission for permission to appropriate for agricultural purposes 3000 cu. ft. of water per second from Big Rock Creek. The pipe line to convey the water to the lands will be one and three-fourths miles long and the project will be known as Big Rock Creek Irrigation Project. Included in the work is a dam 110 ft. high, impounding 5600 acre ft. and a reservoir covering 142 acres. The estimated cost of the dam is \$90,000 and of the pipe lines \$40,000.

ONTARIO, Cal.—Meetings have been held in Victorville, Apple Valley and in Los Angeles to formulate plans for financing and organizing the Victor Valley Irrigation District and to arrange for purchasing properties owned by the Arrowhead Reservoir & Power Company. The water district must be formed and money raised during the next four months, so that bonds may be voted to obtain the water company's properties. The sum of \$2,500,000 will be necessary. The acquisition of water with proposed pipe line and irrigation ditches will reclaim close to 100,000 acres of land.

PLACERVILLE, CAL.—The great water system purchased several years ago by the Bea, Tevis and San Francisco Oakland Terminal Power Company as a possible supply for San Francisco, has been sold by the Placerville Gold Mining Company to the Western States Gas & Electric Company for a consideration of over \$100,000, it became known recently upon the return of President Alexander Baring, who concluded the sale. Deeds are now being drawn. The system includes the waters of Echo, Silver and Andrane lakes and the South and Silver forks of the American River, and is one of the largest undeveloped systems in California.

ALPHABETICAL INDEX TO ADVERTISERS

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| B-1 Baker-Joslyn Company.....
71 New Montgomery St., San Francisco; 911 Western
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| C-1 Century Electric Co.....
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Ore.; San Fernando Bldg., Los Angeles. | N-6 National Carbon Co.....
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cisco; Mutual Life Bldg., Seattle; Santa Rita Hotel
Bldg., Tucson. | |

JOURNAL OF ELECTRICITY

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Devoted to the Conversion, Transmission and Distribution of Energy

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BY R. H. CATES.

SELECTED ILLUSTRATIONS IN EFFICIENCY STUDY

BY E. L. HALL.

LAMP SOCKET HEATING DEVICES

BY E. A. WILCOX.

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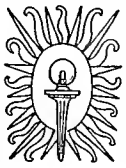
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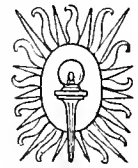
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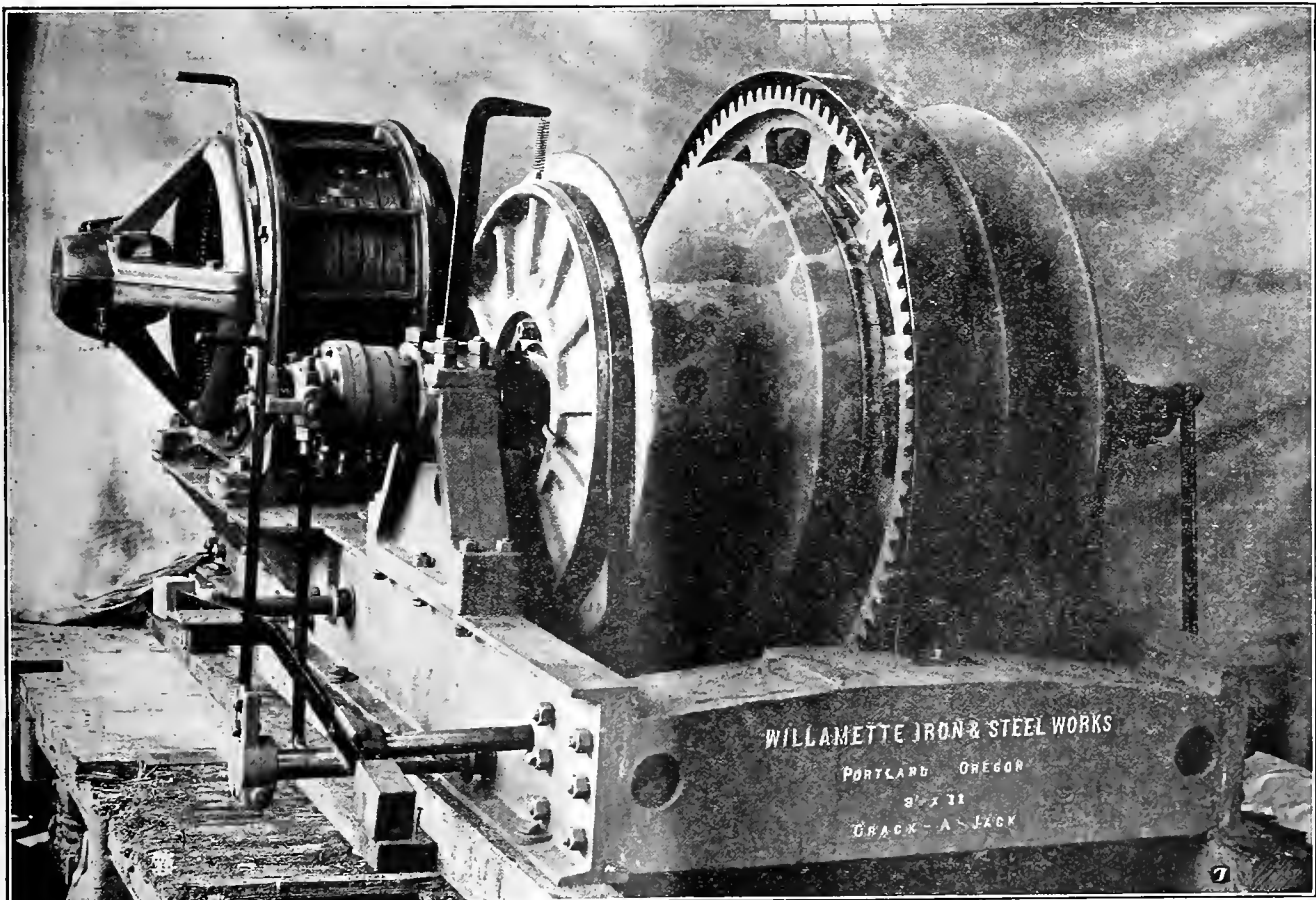
ELECTRIC VS. STEAM LOGGING

BY W. D. PEASLEE.

(This excellent paper gives much valuable information relative to the comparative costs of the electric and steam operated donkeys as used in the great logging industries of the northwest. The author is a consulting engineer at Portland, Oregon, and presented this paper before the recent Pacific Coast Logging Congress at Portland.—The Editor.)

The final answer to the question as to which logging machine is most suited for a particular duty is made up of two parts. The first and most important is represented by the dollar mark, and is a comparison of all the advantages and disadvantages that

In this paper an endeavor will be made to compare the electric and steam donkeys on as reasonable a basis as possible with especial attention to the question of cost and brief mention of the factors that are not readily evaluated when they bear on the question.



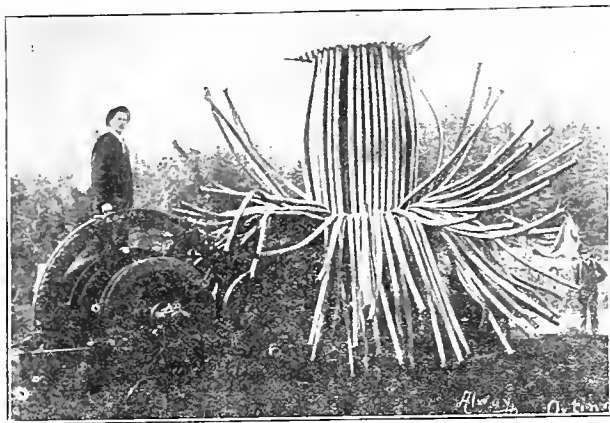
The Modern Electric Donkey as Used for Logging in the Northwest.

can be expressed in terms of money, met with in doing the work with each machine. The second consists of more intangible advantages accruing from the operation of one or the other which cannot be readily expressed in dollars and cents.

The cost of logging, or any other operation, is made up of operation and fixed cost as follows:

Electric Operation.

1. Labor.
2. Supplies including fuel, water, oil, waste, etc.



A Sad Experience in Steam Logging Not Encountered Under the Electrical Method.

Interest on the investment required.
Maintenance.
Depreciation.
Taxes and insurance.

These are readily determined and expressed in dollars and cents. In a comparison of the two machines however, the following items must also be taken into consideration.

Production. (Can be saved.)
Fire damage. (Can be approximated roughly.)
Safety. (Hard to value.)
Special advantages (Hard to value.)

The question of operating costs has been rather fully dealt with in a previous paper and will be reviewed here, though for the complete discussion those interested are referred to that article. (Timberman, June, 1916, page 46).

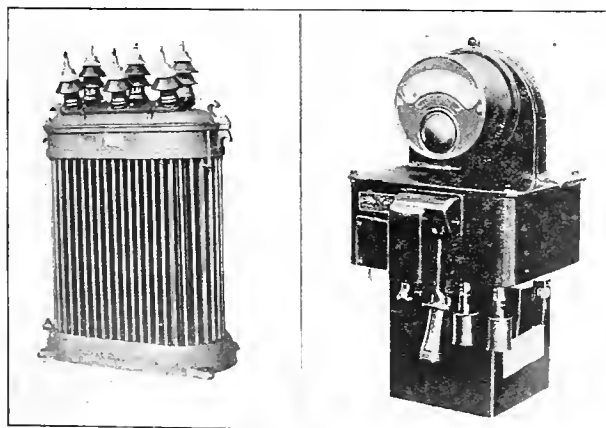
It is generally conceded that the logging operation proper amounts to about thirty-five to fifty per cent of the cost of logs at the mill and the cost of use of the donkey is a large factor in this cost.

The terms "cost of use" has been adopted here as the expression "cost of logging" includes such labor costs as felling, wire rope costs, and other items that are not affected by the particular type of donkey employed in ground yarding.

Steam Operation.

The items that affect the cost of operation of the steam donkey may be grouped as follows:

1. Fuel costs.



The Electric Transformer Used for Logging and the Instruments for Control.

This includes the actual cost of the fuel used. In the case of wood burning donkeys it has been found that the wood used is usually taken from pretty good logs because it splits easy and so is usually under-valued. The logger has to get the steam.

2. Labor costs.

This includes the wages of the fireman, wood bucks, and engineer as well as those of the wood cutters and the proper proportion of the wages of the night watch. Also the cost of labor for firing up early to get steam up at starting time.

3. Water.

In most cases this has been found to be a very large factor of expense as water was pumped considerable distances.

4. Character of ground and length of haul.

There is of course wide variance in these factors in the different localities and as a result we find the operation costs of the donkey varying over wide limits as indicated in table I. It will be observed there that for wood-burning donkeys the cost varies from \$16.80 to \$34.95 per day and for oil burning from \$12.90 to \$17.00 per day.

For this reason comparative studies of different camps are very apt to be misleading and, since few camps have electric donkeys in operation it would seem impossible to arrive at a fair statement of the comparative cost of operation of steam and electric donkeys. Fortunately, however, data available from the tests of the few electric donkeys now in operation make it possible to arrive at a very close figure to the cost of doing the work done by any steam donkey with an electric machine.

In the first place the following changes are made in the items mentioned as affecting operating costs.

1. Fuel.

For this item we find power cost substituted and due to the uniform conditions as to fuel costs at a power plant and other factors mentioned later this cost per horsepower hour will vary little, and for the purpose of this discussion will be taken at a figure that is known to be possible either with purchased power or with power generated by the logging company.

2. Water.

Eliminated completely.

3. Character of ground and length of haul.

This feature can be taken care of for each comparison by a careful study of the particular conditions of haul and the power taken by an electric donkey under hauls as near the same as possible and averaging the results. This will give comparative figures for the particular case under consideration but the ratio so secured must not be used to cover all cases as a general comparison made from specific cases is often misleading. It is very interesting to note that in a few cases where it has been possible to obtain actual comparative tests of steam and electric machines the above method of comparison has given results very much in agreement with the test figures.

To the logger, to whom the electric donkey is a very new thing and so to be regarded with con-

siderable suspicion and distrust it may be said that the electric logging donkey is to the electrical engineer merely a very special form of the common hoist, which has been operated successfully by electricity for some time, and when studied as such and applied with a large proportion of common sense to the actual conditions that must be met in logging practice it is not at all difficult to predict what it will do and how much it will cost to do it.

Considerable data is available in the form given in table II from which we make a detail study of the work being done by a steam donkey and determine closely the cost of doing the same work with an electric machine. By a careful analysis of a large amount of data such as is given in this table the cost of doing with an electric donkey the same work as has been done by the steam equipments has been computed and tabulated in table III. In the case of the "H," company the first electric cost is the result of an actual comparative test and the second electrical cost figure given was computed by the method above outlined.

These figures are based on a power cost of 1.5 cents per kilowatt hour (1.12 cents per horsepower hour) which figure can in some cases where the power is generated near the point of use or is purchased from power companies whose lines run near the donkeys, be considerably reduced. One power company has offered to run short lines and sell power at the donkey at a price that with ordinary use will cost 1.33 cents per kilowatt hour (0.99 cents per horsepower hour) and another offered power for a combined mill and logging load, delivered at the mill substation at a price that with the average load factor of such a load would amount to three-quarters of a cent per kilowatt hour, which when the maintenance and fixed costs of the transmission line were considered, gave for that particular case a power cost of 1.22 cents per kilowatt hour (0.905 cents per horsepower hour). In view of these facts the use of the figure of 1.5 cents per kilowatt hour (1.22 cents per horsepower hour) is not unreasonable. Taking the figures secured by Mr. Peed of the Hammond Lumber Company, Samoa, Cal., it would show an electric power cost of less than \$6 per day at time of operation.

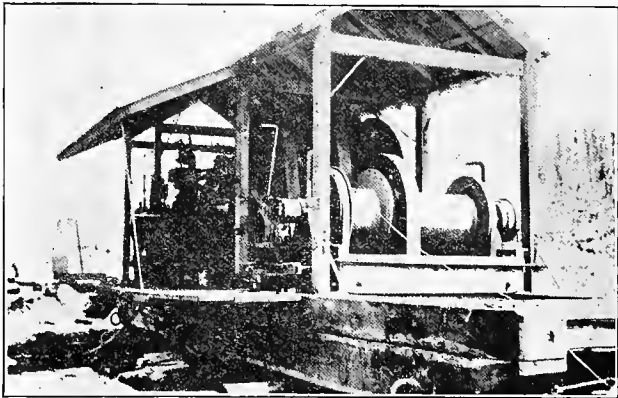
An investigation of the data available shows very clearly that as shown in tables 1 and III as far as operating costs are concerned the electric donkey will do the same work cheaper than the steam donkey either with wood or oil burning machines.

Fixed Charges.

The total cost of use of either machine however includes as was previously outlined, what are commonly termed the fixed charges and we will now proceed to an investigation of the effect of these costs on the comparison.

The figures upon which the following costs are based are derived from estimates and bids that were secured in the course of investigations made by the writer as to the advisability of electrifying the logging equipment in two camps of the Northwest. The prices are for machines laid down at the logging camp or nearest rail connection and while they are not at the present time reliable as up-to-date quotations, they represent very closely the comparative cost of the two

machines, though differences in freight charges and the element of competitive bidding would be likely to alter somewhat the relative costs of similar machines if purchased at the present time. The difference would



The Portable Electric Donkey as Installed in the Logging Area.

be small and would have to be greatly in favor of the steam equipment to materially change the relative final comparative results.

Interest on each investment will be assumed at six per cent. It will also be assumed that the company will generate its own power and that it can do so at a cost of 1.5 cents per kilowatt hour at the donkey, burning mill refuse under the power plant boilers. The saw mill will be electrically driven and 35 per cent of the charges of the power house and building will be applied to the logging operation, the rest being properly chargeable to the mill. These and all the charges on the transmission line are considered in the cost of power at the donkey. The charges on the transformers and logging engine investment will be fully applied to the logging operation.

If power is purchased at 1 cent per kilowatt hour at the substation and distributed, the conditions will be about the same as this and will just about give 1.5 cents per kilowatt hour at the donkey.

The following summary of costs per donkey is based on an installation of five machines.

	Investment per Donkey.
Building 35 per cent of proportionate building cost.....	\$ 1,050.00
Power station on same basis	5,330.00
Transmission line	3,200.00
Step down transformers logging donkeys and cables...	6,550.00
Total investment per donkey.....	\$16,130.00
The fixed charges on the building, power station, and transmission line are considered in the price of 1.5 cents per kilowatt hour at the donkey. It will cost less than 1 cent at the power house switchboard. Therefore the total investment on which charges are to be considered is that in the donkey, step down transformers, and armored cables. The fixed charges therefore, are:	
Interest 6 per cent	\$ 393.00
Maintenance 5 per cent	327.50
Depreciation 5 per cent	327.50
Taxes and insurance 3 per cent.....	196.50
Total fixed charges	\$1,244.50
Changes in transmission line due to changing location of donkey, this means moving donkey 3 miles per year	600.00
Operation 300 days at \$13.05 per day (Company G, Table III)	3,915.00
Contingencies	200.00
Total cost of use	\$5,859.50

In this time it will handle on a basis of the same production as the steam donkey with which it is to be compared, on a basis of 96,000 ft. B. M. per day, which is handled at a cost of 20.35 cents per 1000 ft. B. M.

For steam donkey operation we have the following data:

One steam donkey 11x13 complete.....	\$5,230.00
Operation 300 days at \$17 per day, oil burning.....	5,100.00
Maintenance from records	463.70
Depreciation 10 per cent.....	523.00
Repairs from records	193.10
Interest at 6 per cent	313.80
Taxes and insurance 3 per cent.....	156.90
Total cost of use.....	\$6,750.50

This is a cost per 1000 ft. B. M. of \$.234.

It is shown by tests and the operation of the few electric donkeys that are now in use that the electric donkey will handle from 30 per cent to 50 per cent more logs in a given time than the steam donkey it is designed to replace. To be liberal we will take the figure at 25 per cent and see how the two machines compare on this basis.

The reason for this increased production have been mentioned in the papers given before the Logging Congress and so no discussion is offered here of this feature.

The capital invested does not change, due to this increased production, and the cost of operation changes only in the power item as the cost of labor is the same. So we have for the cost of use, under the various conditions assumed:

	Cost per year.	Cost 1000 ft.
Steam	\$6,750.00	\$.234
Electric, same work as steam.....	5,859.50	.2035
Electric, working at maximum rate..	6,149.50	.1705

Thus simply by virtue of its greater ability to maintain a high rate of doing work the electric donkey has taken 3.3 cents per 1000 ft. B. M. from the costs of logs at the mill and decreased the cost over steam 6.35 cents per 1000 ft. B. M.

Thus on a basis of readily valued factors the electric donkey makes a reduction in the cost of logs at the mill of a little less than 1 per cent. In dollars per year this figure becomes more impressive as it means

$$$.0635 \times 28800 \times 1.25 = \$2285.00.$$

which is 6 per cent interest on \$38,500.

This increased production however results in another saving; that is in the labor cost per 1000 ft. B. M. As the production is increased 25 per cent without increasing the labor in the woods, this labor cost will be reduced 20 per cent. This item must be considered for each camp as a problem in itself easily solved when the number of men working from the donkey are known. In the camp under discussion this saving amounted to \$4500 per year or a further decrease in electric operation over steam of \$.123 per 1000 ft. B. M.

The total saving in this case then may be summarized as follows:

	\$ per 1000 ft. B. M.
Saving in cost of use electric over steam.....	\$.0635
Saving in logging labor due to increased production.....	\$.123
Total saving in cost of logs.....	\$.1865

This is a total saving per year of \$6820; more than the cost of a donkey.

The figures here given represent about the best condition that can be secured for steam operation. An-

other case that has been under investigation analyses as follows:

Electric yarding engine.....	\$6,770.00
Interest 6 per cent	406.20
Maintenance 5 per cent	338.50
Depreciation 5 per cent	338.50
Taxes and insurance 3 per cent.....	203.10
Total fixed charges	\$1,286.30

This equipment was close to the power house so transmission line cost did not enter and power was available at the yarder for 1.3 cents per kilowatt hour and the operating cost of the electric equipment was \$10.65 per day. The costs then are as follows:

Fixed charges	\$1,286.30
Operation 300x10.65 =	3,195.00
Contingencies	200.00

Total cost of use of electric donkey.....\$4,681.30

On this basis of doing the same work as the steam this equipment will handle logs at a cost per 1000 ft. B. M. of \$.213.

For steam operation we have

Steam yarder 13x13	\$6,150.000
Maintenance from records	527.40
Depreciation 10 per cent.....	615.00
Repairs from records	146.25
Interest 6 per cent	369.00
Taxes and insurance 3 per cent.....	184.50

Total fixed cost.....\$1,842.15
Operation 300 x 21.77 =

Total cost of use steam donkey.....\$8,373.15
or a cost per 1000 ft. B.M. of \$.38.

Now on a basis of the electric yarder doing 25 per cent more work than the steam, we have:

Fixed cost	\$1,286.30
Contingencies	200.00
Operating costs 300x11.80 =	3,540.00

Total cost of use of electric.....\$5,026.30
or a fixed cost per 1000 ft. B. M. of \$.1832.

Thus we have for the cost of use under various conditions assumed:

	Cost per year.	Cost 1000 ft.
Steam	\$8,373.15	\$.38
Electric, same work as steam.....	4,681.30	.213
Electric, maximum rate	5,026.30	.1832

This is a saving of \$.1968 per 1000 ft. B. M. or a total saving on a year's logging over the cost of doing the same work by steam \$5400, which at 6 per cent represents a capital investment of \$90,000, or looking at it from a slightly different point of view it will pay for one machine in fifteen months.

Note that the \$200 contingency charge was not put on the steam operation, thus giving it that much advantage.

In the saving in labor cost, due to increased production, for this camp the saving would amount to \$7080 per year or a saving per 1000 ft. B. M. of \$.2575.

	\$ per 1000 ft. B. M.
Summarizing—	
Saving in cost of use electric over steam.....	\$.1968
Saving in logging labor due to increased production.....	.2575
Total saving in cost of logs.....	.4543

This is a total per year of \$12,500, more than twice the cost of a machine.

We will now investigate the influence on the situation of the more intangible factors.

Fire risk is entirely absent with the electric machine. It is difficult to value this factor but in one camp in the Northwest with the operation of which the writer has been connected, the total cost of fighting fire, not including the cost of the resulting decrease in output of the camp, was \$2650, and 60 per cent of

the fires were started by the donkeys, which were using wood as fuel. It is our experience that oil burning reduces the fire hazard to about one-fourth that caused by wood burning donkey. In considering this factor each one must set a value on it based upon his own individual experience and judgment and different values will naturally be assigned by different operators.

The possibility of electric shock from the donkey is very remote and entirely negligible if all metal parts of the equipment are thoroughly grounded.

TABLE I						
Operating Costs of Steam Donkeys						
Company	Operation	Fuel	Fuel Cost	Operation Cost per day \$	Logs handled ft. B.M.	Cost M. ft. B.M. \$
A	Yarding	Wood	\$7.00 M	34.85	14x14	80000
A	Yarding	Oil	\$1.16 Bbl	16.80	14x14	83000
B	Loading	Wood	\$7.00 M	19.80	13x13	
B	Loading	Oil	\$1.00 Bbl	12.90	13x13	
C	Loading	Wood	\$7.00 M	18.60		73000
C	Yarding	Wood	\$7.00 M	19.25	11x13	67000
D	Yarding	Oil	\$1.16 Bbl	14.30	14x14	76000
E	Yarding	Wood	\$7.00 M	21.97	13x13	73400
F						
G	Yarding	Wood	\$7.00 M	21.38	10x13	62000
G	Yarding	Oil	\$1.16 Bbl	16.76	10x13	81400
G	Logging	Oil	\$1.16 Bbl	17.00	11x13	95600

TABLE II					
Power required by electric donkey for various operations					
Work performed	Time sec.	Distance Feet	Kilowatts Max.	Min.	Remarks
2 logs—1900 ft. B. M.	680	840	315	147	On skids, up 5° slope
1 log—1050 ft. B. M.	360	470	240	180	Clear ground, up 10° slope
2 logs—1150 ft. B. M.	480	600	365	153	Level rough ground and brush
1 log—740 ft. B. M.	440	590	163	84	Level clear ground
Tightening standing line					
2800 ft. 1½" steel cable	10		260		
Running trolley out	40-60		100	85	
Pulling in trolley with					
1 log—800 ft. B. M.	40		70		
4 logs—2000 ft. B. M.	65		145		
8 logs—1600 ft. B. M.	60		210		
1 log—1100 ft. B. M.	70		85		
1 log—1800 ft. B. M.	90		96		
Loading cars	3-2		100	70	
Moving cars	3-5		225	26	

TABLE III							
Operating Costs of Electric Donkeys							
Company	Operation	Present steam cost Wood	Oil	Electric Cost	Estimated steam cost oil burning	Logs handled ft. B.M.	Cost M. ft. B.M. Elec. \$
E	Yarding	\$21.77		\$11.25	\$16.60	73400	0.159
A	Yarding	\$38.45		\$11.66	\$17.49	80000	0.146
C	Yarding	\$18.60		\$10.26	\$12.90	73000	0.141
C	Yarding	\$19.25		\$11.16	\$14.96	67000	0.167
G	Logging		\$17.00	\$18.05		95600	0.185
H	Yardug			\$10.90	Test	86000	0.127
H	Yarding			\$11.55	Computed	86000	0.136

The control is compact and easily operated with everything in the most convenient place for the operator. His control over the machine, and decreases materially the liability of accidents.

The general advantages of the electric donkey have been so fully dealt with in previous papers before the Logging Congress that I will not go into them here, but there is one feature that I do wish to bring out.

An illustration is shown for connecting the donkey to the power wires. Over it will be noticed an ammeter or instrument to measure the current taken by the machine. The scale on this instrument can be made to read the pull in pounds on the cable. Protective relays are provided on this switch which can be set at a value that will disconnect the machine from the line when the strain on the cable exceeds any desired value, thus protecting the cable. Further, the operator can see at all times just what the machine is doing.

It is well known that a new cable should be handled with care the first few days it is in use, so that the strands can become properly laid and improper use is sure to shorten the life of the cable very materially. With the device shown the operator can

know at all times the strain on the cable and so avoid overworking a new cable. By making this instrument recording a complete record could be kept of the use of the cable. This with a cyclometer attachment on the cable drum will give a very valuable record of the number of feet that the cable has been used over and the use or strain under which it was used each day. Incidentally this record would also show the amount and time of occurrence of the idle periods of the machine. While most logging operators will consider such information of small value, there is a growing tendency among the operators to pay particular attention to the use to which their cables are put. It is possible that by use of such an equipment cable could be purchased, as automobile tires are at present, on a guaranteed mileage basis providing it was not strained beyond a certain point during the period.

In conclusion then we see that in tangible easily valued costs and considering all costs, the electric donkey will handle logs at a saving over top notch oil burning steam donkeys of \$.1865 per 1000 ft. B. M., and for ordinary service will show a saving of \$.4543 per 1000 ft. B. M. These investigations were made for small camps and larger camps will usually show better results as the transmission line to supply one donkey will cost as much as one to supply ten, thus reducing this charge.

Many cases arise, however, wherein electric logging cannot be made to pay a reasonable return on the money invested and in such cases the only answer is Life's famous advice to young men about to be married—don't.

The success of an engineering project is always measured in terms of the earnings it secures from the money invested and it is on this basis that the decision for or against electric logging must be made. As scientific achievement there is no discussion, it can be done and done well, but as an engineering feat each project must stand or fall by itself, on the basis of the earning power of the money invested.

NEW RATES FOR ALASKAN RADIO SERVICE.

The Director of Naval Communications has announced that, effective October 1, 1916, radio rates, to conform as near as possible to the rates of the Washington-Alaska Military Cable & Telegraph system effective that date, will be placed in effect via the Naval Communication Service in Alaska. These rates will supersede all other rates in effect over this system. All traffic to or from ships at sea will be prefixed "Radio." Cable count will be used. Ten-word minimum will be required. Naval radio stations at St. Paul, St. George, Dutch Harbor, Kodiak, Cordova, and Sitka will apply a 6-cent coast tax. Service between any point in Alaska reached by the Naval Communication Service or the Washington-Alaska Military Cable & Telegraph system and any of these stations will carry a rate of 5 cents per word additional. This will also include North Head or Seattle for local delivery or for transfer to other systems to reach points beyond these systems. The traffic may be routed via either the Naval Communication Service or cable service or both. This rate does not include other line charges, which should be added if it is necessary to employ other lines to reach destination.

TESTS OF IRRIGATION PUMPING PLANTS.

BY R. H. CATES.

The following discussion gives the results of over 300 separate tests of irrigation pumping plants made by the Southern California Edison Company. The tests were made by the power engineering department of the company with methods described in the issue of the Journal for November 4, 1916.

The tests given represent what pumping plants are accomplishing under the average conditions under which they have to operate. These conditions are often variable from year to year due to fluctuations in the elevation of the ground water. This may result in the use of a pump under conditions different from those for which it was designed. It may also result in operation under excessive vacuum with its opportunities for loss in efficiency due to air leaks. It is often necessary to install a pump before the quantity which can be obtained is known so that pumps may operate at discharges different from those at which maximum efficiencies would be obtained.

In many cases the results do not represent efficiencies as high as the pumps are capable of obtaining. They do represent, however, results on which the consumers are paying the cost of pumping and therefore furnish a conservative basis for estimating the probable cost of power.

The actual efficiency of any pumping plant depends on a number of factors. It varies with the type and size of pump, the lift and the discharge. It is not possible to secure a number of field plants where only one of these factors varies. The tests given are considered to be sufficient in number, at least for several of the types and sizes, so that the resulting average efficiencies can be taken as representative of the results which are being obtained under actual field conditions. They may or may not represent what should or might be obtained, depending upon the adaptability of the plant to its conditions and the character of its maintenance.

In Table 1, the general results for all tests are given. These are classified by type and size of pump. Both the efficiency of the pump alone and of the combined motor, transmission, and pump or the overall efficiency are given. As explained in the article in the issue of November 4, 1916, the overall efficiency is the one directly determined in the test, the efficiency of the pump alone being obtained from the rated motor efficiency and an estimated belt loss of 6 per cent.

The number of tests on which each mean is based is also given. This determines the value of the resulting mean; for those sizes for which few tests have been made, the mean results should be given less weight than for the sizes and types where 10 or more tests are available.

In addition to the mean efficiency, some measure of the variations to be expected is of value. It is hardly representative, however, to pick the single maximum or minimum result for each size as the efficiency may be due to unusual conditions. It is considered, however, that the mean of the lowest one-fifth of the results should be representative of the lowest efficiency to be expected. Any lower efficiency would be due to poor judgment in construction or operation and would not

be the fault of the conditions. In the same way the mean of the highest one-fifth of the results should represent the maximum efficiencies to be expected under favorable conditions. The figures for the minimum and maximum results were prepared on this basis. Where only a small number of tests were made only the mean values are given.

The mean ratio of the overall to the pump efficiency is also given. This represents the efficiency of the motor and belt where the belt connection is used. It is higher in the types where direct connection is used.

The discharges are expressed in miners' inches. The value used is one-fiftieth of a second foot, or 9 gallons per minute. This value of the miners' inch is the unit of measurement used in the territory served by this company.

The equivalent miners' inches pumped through a lift of 100 ft. per kilowatt of input were also computed. This represents the results for which payment for power is made. For 100 per cent efficiency, one kilowatt would lift 5.90 miners' inches through a height of 100 ft. The figures given can be converted into second feet lifted one foot by multiplying by two. The number of kilowatt hours required to lift one acre foot of water one foot high is given in the last column of Table 1. This unit is used in comparing irrigation pumping plant performances in many localities. For perfect efficiency 1.025 kilowatt hours are required to lift one acre foot one foot in height.

Average lift and vacuum are also given. These vary widely for the different tests comprising the mean results. They represent average conditions in the area served by the company rather than the lift for which the size of pump may be best suited.

These tests were made during 1913 to 1916. They represent plants in use during those years including many installed before 1913. In the case of some types of pumps, such as the well turbines, the plants now being installed have much higher average efficiencies than those built 2 or 3 years ago. No distinction has been made between various makes of pumps. In all the types given a number of different makes are represented.

Owing to the number of separate factors which may affect the efficiency of a pump, it is not practicable to segregate the effect of any single factor in a sufficiently large number of cases to furnish reliable averages. Certain segregations are attempted in the discussion. They are suggestive rather than conclusive, however.

In Table 2, the results of some selected tests are given. These are mainly on plants for which more than one test has been made and show the effect of different conditions. The individual conditions are given in the remarks.

In the discussion of each type of pump some comparison with the efficiencies obtained with other types are given. Such comparisons are on the basis of efficiency alone. In selecting the type of pump for any particular plant, efficiency is one of the most important factors to be considered. There are other factors, however, which need to be taken into account, such as first cost, maintenance and ease of operation, the final choice being based on all such factors.

Table 1.—Summary of Results of Tests of Irrigation Pumping Plants.

Type of Pump.	Size of Pump.	Mean Discharge in Miners' Inches.	Mean Total Lift. Feet.	Mean Vacuum. Feet.	Number of Tests.	Efficiency of Pump in Per Cent.			Overall Efficiency of Plant in Per Cent			Miners' Inches Pumped per Kw. of Input per 100 ft. Lift.			Kw. Hours Used to lift one acre-foot 1 ft.			
						Mean of all Tests.	Mean of Lowest 20% of Tests.	Mean of Highest 20% of Tests.	Mean of all Tests.	Mean of Lowest 20% of Tests.	Mean of Highest 20% of Tests.	Ratio of Overall to Pump Efficiency.	Mean of all Tests.	Mean of Lowest 20% of Tests.		Mean of Highest 20% of Tests.		
Vertical Centrifugal.....	2½	10	119	7.7	3	30.	..	..	23.3	..	..	77.7	1.38	..	..	4.4
	3	17	84	19.2	9	33.0	21	44	26.6	16.8	35.6	80.6	1.57	..	2.10	3.9		
	4	50	88	18.6	12	46.8	30	60	38.1	27.9	49.0	81.4	2.25	1.65	2.89	2.7		
	5	64	75	18.8	51	47.8	34	61	39.4	29.2	51.5	82.4	2.33	1.72	3.04	2.6		
	6	106	83	15.4	54	54.8	39	69	45.6	31.6	58.3	83.2	2.69	1.86	3.44	2.2		
	7	131	83	20.3	21	56.5	37	74	48.6	29.0	60.8	86.0	2.87	1.71	3.59	2.1		
	8	241	83	17.5	9	64.4	50	76	51.6	40.5	64.4	80.0	3.05	2.39	3.81	2.0		
	10	360	110	13.6	13	60.8	..	..	51.	..	..	83.9	3.01	..	..	2.0
	Horizontal Centrifugal...	2	13	41	9.8	13	34.	27.4	80.0	1.62	3.7	
		3	28	90	17.0	33	40.4	33.8	83.6	1.99	3.0	
3½		58	71	2.9	2	56.	..	..	47.7	..	..	85.2	2.81	..	..	2.1
4		54	129	7.2	6	54.6	40.5	75	46.5	36.2	61.9	85.2	2.74	2.14	3.66	2.2		
5		38	45	..	1	52.5	..	..	42.2	..	..	80.4	2.49	..	..	2.4
6		86	174	25.4	3	51.9	..	..	44.5	..	..	85.7	2.63	..	..	2.3
7		170	44	29.4	1	54.	..	..	45.0	..	..	82.9	2.65	..	..	2.3
8		226	131	7.1	9	60.9	43	78	53.1	38.0	71.4	87.2	3.13	2.24	4.21	1.9		
12		325	42	28.0	3	55.4	..	..	47.7	..	..	86.1	2.82	..	..	2.1
10		71	134	..	5	56.0	..	..	47.3	..	..	86.2	2.93	..	..	2.2
Well Turbines	12	63	94	..	25	49.7	33	61	40.5	26.8	50.1	81.5	2.39	1.58	2.96	2.5		
	14	80	55	..	4	39.5	..	..	32.6	..	..	82.5	1.92	..	..	3.1
	15	84	113	..	8	50.1	39	62	41.4	31.7	51.5	82.6	2.45	1.87	3.04	2.5		
	16	103	47	..	2	51.8	..	..	42.8	..	..	82.6	2.53	..	..	2.4
	20	142	88	..	13	54.8	..	..	41.5	..	..	75.7	2.45	..	..	2.5
	24	115	130	..	9	55.6	38	68	46.6	31.6	58.5	83.8	2.75	1.86	3.45	2.2		
	..	116	61	..	21	43.3	29	55	35.7	24.5	46.7	82.5	2.11	1.45	2.75	2.9		
	Propeller Piston Pump—	
		Deep Well Type	28	189	..	7	58.9	48.0	32.	72.	81.5	2.84	1.86	4.22	2.1
		Duplex	129	236	..	12	79.6	71.7	90.	4.23	1.4
Triplex	83	147	..	7	79.6	76	84	66.7	62.	73.	83.8	3.94	3.63	4.30	1.5	
Air Lifts .....	..	42	123	..	7	27.4	10	39	23.1	8.	33.	34.3	1.36	.49	1.93	4.4	

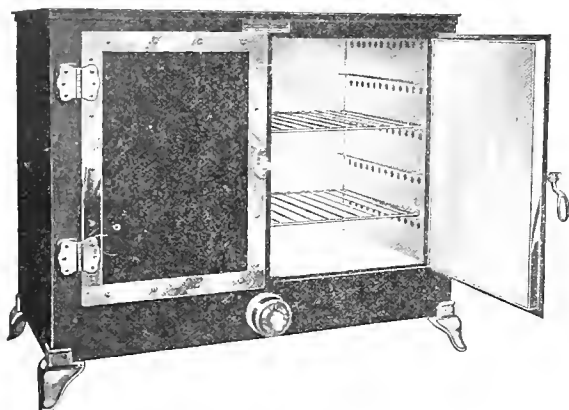
Table 2.—Typical Tests of Irrigation Pumping Plants.

Type of Pump.	Size of Pump.	Total Lift, Feet.	Vacuum, Feet.	Discharge in Miners' Inches.	Efficiency of Pump.	Remarks.
Vertical Centrifugals	3	113.	31	15.2	39.4	(2-Stage pump run at same speed.
	..	127.	19	8.2	21.3	(Discharge too small for pump in second test.
	4	28.4	0	22.2	11.7	Pump found to be running backward.
	..	51.8	14	66.1	57.5	Running in correct direction.
	4	118.	28	40.5	39.5	2-Stage pump balance rings worn.
	..	120.	28	41.6	50.	Same repaired.
	5	115.5	25	54.6	36.8	2-Stage pump.
	..	105.8	15	84.	58.3	Same, year later, water level higher, larger flow.
	6	53.3	0	125.4	48.5	Runner in use for ten years.
	6	59.4	23	142.	60.	After stopping air leak.
	..	34.8	0	65.	26.9	Bad air leak, couldn't get a vacuum.
	6	62.6	16	63.3	32.6	Out of balance, runner worn.
	..	66.5	17	95.1	58.5	18 months later, refilled and new runner.
	6	66.8	23	116.	63.1	
	..	64.3	20	120.8	57.5	Same 3 years later.
	7	78.6	25	110.1	49.2	Discharge too small for this 7-inch pump.
	6	88.4	29	119.5	63.8	Replaced with 6-inch pump.
	7	34.4	29	143.	49.7	604 r.p.m. before overhauling.
	..	81.2	15	108.	49.2	690 r.p.m. before overhauling.
	..	72.4	12	98.	64.5	630 r.p.m. after overhauling.
Horizontal Centrifugal—Turbine type...	7	41.8	16	135.	13.1	Air leak and runner plugged.
	..	50.2	18	107.	46.8	Same, runner cleaned, same air leak yet.
	8	27.5	28	294.	46.6	Low head and speed.
	..	45.8	20	282.	77.8	Same, head and speed increased.
	8	96.5	26	250.	53.6	Vacuum high.
	..	120.7	0	282.	74.5	Same, lower vacuum, higher lift.
	8	165.	..	209.	54.2	
	..	169.5	..	210.3	52.2	Year later.
	4	93.5	24	34.4	33.3	2-Stage.
	..	105.7	24	33.3	39.3	
Well Turbine—10-stage	12	102.4	..	40.6	54.4	Replaced vertical centrifugal above.
	..	107.5	..	35.2	50.7	Turbine—year later.
Air Lift .....	..	113.1	..	22.5	25.5	
Well Turbine—6-stage.....	12	115.7	..	31.8	54.1	Replaced air lift above.
	..	117.7	..	38.7	54.7	
	15	55.	..	115.8	40.2	2-Stage.
	..	58.	..	134.6	49.4	Same, 100 ft. of 6-inch suction pipe removed.
	20	38.6	..	156.3	42.4	4-stage—lift too low.
Deep Well Plunger.....	..	136.6	..	127.3	67.2	
	..	148.7	..	19.9	55.6	Low lift.
Horizontal Duplex .....	..	273.3	..	19.3	61.	Same pump—high lift.
	..	238.	..	129.5	76.8	
Triplex Plunger .....	..	233.	..	128.5	82.5	Same pump—6 months later, worked over.
	..	97.1	..	81.3	75.5	Low lift.
Deep Well Plunger.....	..	229.	..	79.	78.5	Same pump—high lift.
	..	194.	..	23.2	38.1	Gas in water.

LAMP SOCKET HEATING DEVICES.

BY E. A. WILCOX.

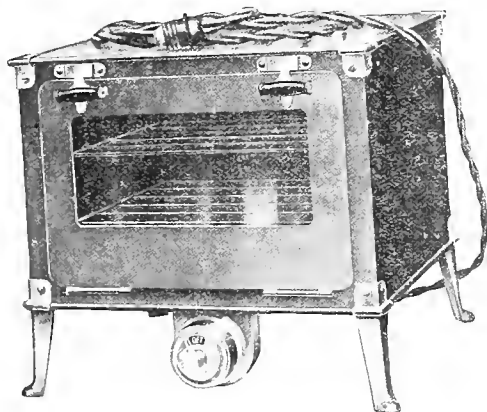
Plate Warmers and Hot Closets.—A variety of shapes and sizes of plate warmers and hot closets are manufactured in order to fit available spaces, or standard portable types may be used.



Hughes Plate Warmer.

In estimating the size of a plate warmer closet a shelf space of at least $10\frac{1}{2}$ in. should be allowed for ordinary dinner plates and a height of 6 in. for twelve in a pile.

On account of the relatively low temperature required inside the oven, the current consumption is usually low, especially if the walls are well insulated against heat losses.



Hot Point El Bako.

Bake Ovens.—Devices like the small Hotpoint lamp socket bake ovens (El Bakos) are useful for light baking operations. The inside dimensions are 11 in. by $10\frac{1}{2}$ in. by $7\frac{1}{2}$ in. and they consume 600 watts on the high heat. They are of steel construction with nickel trimmings and the walls are lined with mineral wool

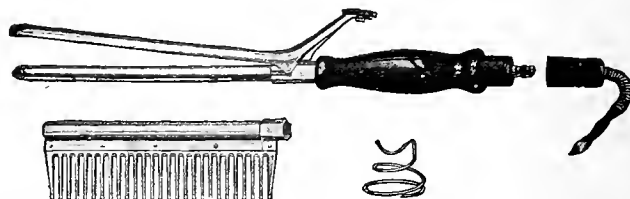


Simplex Nursery Milk Warmer.

to retain the heat. These ovens have practically all the inherent advantages of larger electric ovens.

Nursery Milk Warmers.—These consist of a water designed for quick heating and are made in capacities vessel and cover, a milk bottle, and a nipple. They are varying from 300 to 500 watts. They are ready for use at any time—day or night. The 500 watt size will heat a bottle of milk in about four minutes or boil a pint of water in about six minutes.

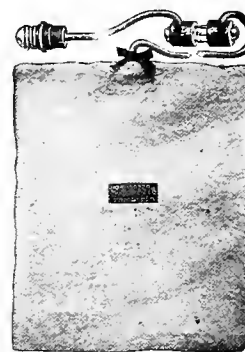
Curling Iron Heaters.—These are desirable on account of their absolute cleanliness, convenience, and safety. They are made in capacities varying from



Universal Curling Iron and Hair Dryer.

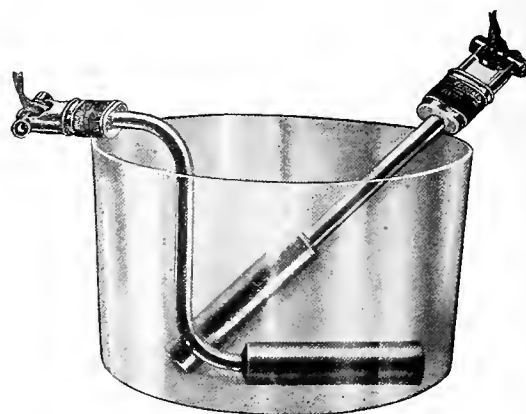
60 to 90 watts and in plain or ornamental types. The Westinghouse electric curling iron is equipped with a heating element inside the iron which consumes 15 watts.

Warming Pads.—For local applications of heat to the body electric pads are rapidly superseding the



Simplex Warming Pad.

hot water bottle and similar devices. These pads are usually made of soft padded cloth although some of the new Hotpoint pads are made of either rigid or



Hot Point Immersion Heaters.

flexible metallic materials. The Westinghouse pads are 11 in. by 15 in. and have an outer rubber cover. The Simplex pads have an eiderdown cover and are made in two sizes, 12 in. by 15 in. and 15 in. by 24 in.

The American warming pad is 12 in. by 13 in. Warming pads are generally provided with regulating switches giving three degrees of heat. The capacities vary according to dimensions from 50 to 100 watts maximum. The American sweating blanket is 5 ft. long by 18 in. wide and requires 800 watts.

Immersion Heaters.—These appliances are useful in the home that is not provided with a constant supply of hot water. By fastening to the lamp socket and submerging the heater in water or other liquid the substance can be brought to a boil very quickly. Inasmuch as the heating element is placed directly in the liquid the efficiency of operation is high. They are handy for shaving and similar purposes. Heaters of various shapes and capacities are available.

Other Household Devices.—A few of the better known heating and cooking devices are mentioned for reference purposes.

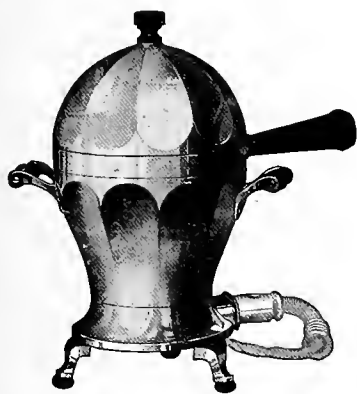
Egg boilers are convenient because they can be used on the table and given personal supervision.

Fry pans and saute pans designed for use on the dining room table are useful.

Soup tureens are handy for keeping soups and other prepared foods at the proper temperature for serving.

The Hotpoint utility outfit which comprises a three pound iron provided with a stand on which it may be inverted for cooking, and a receptacle for inserting a curling iron is useful for the roomer or traveler.

The foot warmer is a handy device for use in rooms with cold floors. If placed under a desk or



Universal Egg Cooker.

table it will keep an occupant warm even when the room is comparatively cold.

Air radiators of both the radiant and convection types are useful in small rooms and in cold corners. A separate chapter is, however, devoted to the subject of air heating.

The electric range campaign continues unabated. At Kalispell, Montana, forty-three electric ranges have been installed by the Kalispell division of the Northern Idaho & Montana Power Company since the start of the electric range campaign, October 15. Again, at Eureka, California, a campaign to interest housewives in electric ranges has been started by the Eureka division of the Western States Gas & Electric Company. Twenty ranges have been sold, sixteen of which will be installed in an apartment house.

SELECTED ILLUSTRATIONS IN EFFICIENCY STUDY.

BY E. L. HALL.

(The following excerpt from a paper presented by the author before the recent Pacific Coast Gas Association Convention at Santa Barbara ably illustrates methods of efficiency study in public utility problems. The author is with the Portland Gas & Coke Company.—The Editor.)

It has often been stated that no rule of thumb method is available for efficiency studies, for which reason it is easier to illustrate by example. It frequently happens that the employes have themselves, no adequate conception of the amount of work which they are capable of turning out without fatigue; the following will illustrate:

At the new plant of the Portland Gas & Coke Company there are several acres in green lawn, which being assiduously watered grew apace. The care of this lawn was entrusted to a professional gardener hired for this purpose. The writer noticed on one occasion that this man was being assisted by a helper and upon inquiring the reason was told that the gardener objected to the amount of work as being too much for one man. Now this might seem a very reasonable contention to any business man used to caring for only a small grass plot, under the diligent coaching of his spouse, and his explanation was accepted. Later on, the writer had a time study made which revealed the curious fact that a man working at a very medium rate and resting when needed could care for the lawn with the utmost ease during four days out of a week. It is equally curious that this man was apparently busy and likewise his helper, while taking nearly twice the necessary amount of time to do the same work. The conclusion to be drawn from this illustration is that no adequate conception can be had that constitutes a standard task until studies have been actually made.

A very detailed study will now be given of the manner in which efficiency control was established in the arc maintenance department of the Portland Gas & Coke Company.

At the inception of the investigation the detail cost records while kept with considerable care and interest by the arc foreman yet did not balance out with the actual expense as shown on the company's books. The first step was, therefore, to prepare such reports in an accurate and authoritative manner. This done, it was found that the actual cost per arc cleaned was nearly 5c higher per arc per month than indicated on the old report, thus showing the necessity of a close relation between the cost records and the general ledgers. The next step was to compile a detailed record for each of the employes of the department which was published monthly, at the meeting of the arc trimmers. This report contained among other information, for each employe the total number of arc calls per month and per day with the labor per arc call, material per arc call, mantles per 100 arc calls, and globes per 100 arc calls.

This publicity work together with the coaching of the men at the meetings, did a great deal towards improving results.

Meanwhile time studies were being prosecuted on the work by one of the cadet engineers, whose observations are summarized as follows:

The observer accompanied different trimmers on their routes for a period of eight days, and studied the number and sequence of operations necessary for the general maintenance work on arc lamps. After becoming familiar with the routine and operations, these were segregated into distinct operations and the time was noted for a large number of trimmers which it took to perform each operation, and the same were recapitulated, as follows:

Arc Maintenance, Tentative Standards.		Minutes.
I	Spot ladder and box.....	$\frac{1}{2}$
II	Cleaning ceiling plate or reflector.....	$\frac{1}{2}$
III	Clean casing of arc.....	1
IV	Clean globe.....	3
V	Clean burner tips, gauze, etc.....	2
VI	Remove and clean Bunsen tube.....	3
VII	Clean chain.....	$\frac{1}{2}$
VIII	Secure signature and get out.....	$\frac{1}{2}$
Total		11

During the investigation considerable lost motion was discovered, as a result of which the following suggestions for improvement were made:

Cleaning and drying cloth to be carried on the upper cross strap on the back of each step ladder.

Box of silica paste to be carried in hip pocket and placed on top of ladder when being used.

Pliers, and screw drivers, to be carried in hip pocket and Bunsen brush in breast pocket.

Other tools and material to be carried in case. A small screw hook should be placed on the side of the ladder near the top for holding arc nets when removed for cleaning the globe.

With this disposition of tools and equipment an arc can be completely cleaned with one trip up the ladder. In this connection the following instances of lost time and inefficient methods were noticed:

A trimmer carried his silica paste in his case, removed a globe and brought it to the ground to clean. Lost motion, here, is one trip up and down ladder and opening box once. A trimmer carried his cloth in his carrying case, and at each address it was necessary to open box and get his cloth and close box before starting up ladder. A trimmer on removing net from globe, fastened it to the chain pull of the arc while another carried the net on his head while cleaning the globe, still another trimmer carried his tools in his coat and his coat hanging on the ladder.

As a result the above standards were reduced to $7\frac{1}{2}$ minutes. These time studies taken together with the known distance to be covered in getting from arc to arc, made it possible to work out a combination of cleaning time and walking time, from which scientific rates were worked out on a sliding scale basis in accordance with the number of arcs in each place and also as a means for determining the proper standards for the particular route.

An inventory was also made of the classes of establishments in which the arcs were located in order to determine the severity of usage, and from this data was compiled a correction factor to each class of business for determining the number of calls necessary above or below normal to maintain the arc in a proper operative condition. With this information at hand it became possible to considerably reduce the number of arc calls made in some places without any loss in efficiency, and indeed a portion of the saving in clean-

ings were given without extra charge to many places where the kind of service required more frequent attention.

As a result of all this information the average number of cleanings per arc for each month in the year, in accordance with the lighting hours, was calculated, giving also due consideration to the influence of such factors as wind and snow in the winter, flies and dust in the summer. This data was plotted on a curve and the foreman of the arc department was directed to clean all lamps in accordance with this curve, to which he should apply the proper correction factor in each place in accordance with the class of business.

The number of cleanings thus derived gave the average cost per arc per month for each month in the year, and was recorded graphically as a basis for cost control. This curve together with the actual results is illustrated below. It will be seen that the theoretical calculations were conservative and were easily realized and in fact greatly bettered. A jog in the curve will be noticed, on one month of the schedule, as a result of which the cost for that month went to pieces, but the condition was immediately rectified, showing the value of this method of operating control.

Accompanying this endeavor to reduce operating costs, all complaints were very carefully watched, and the same recapitulated in such a manner as to afford general instructions to the trimmers at their cost meetings, at the same time, a perpetual lamp to lamp inspection was inaugurated and the defects found in each lamp recapitulated according to the nature of the defect and by trimmers.

The data thus collected formed a basis of individual instructions to trimmers and resulted in a marked and immediate improvement in the quality of the work, irrespective of the fact that the costs were being reduced at the same time.

As a result of the above time studies the costs were reduced in this department in three years by $34\frac{1}{2}$ per cent, while the quality of the service was considerably bettered.

DESIRABLE PROPERTIES FOR GASOLINE PURCHASES.

According to the Director of the U. S. Bureau of Mines the essentially desirable properties of gasoline may be stated briefly as follows:

(1) Neither the gasoline nor its products of combustion should have a strong or markedly disagreeable odor, this being objectionable to users of automobiles.

(2) The gasoline should be free from matter which is not hydrocarbon, such as water, sediment, acid, etc.

(3) The gasoline should be free from bodies which either originally or after combustion attack the metal composing the engine. Unremoved acid in refining, and excessive sulphur content, fall under this head.

(4) The gasoline should not contain excessive percentages of unsaturated or aromatic hydrocarbons, since some evidence is at hand which indicates that there may be limits in the ability of motors, as at present constructed and adjusted, to utilize these products,

SPARKS—CURRENT FACTS, FIGURES AND FANCY

According to estimates Russia possesses more than thirteen million unharnessed horsepower in the rapids and waterfalls of its important industrial and metallurgical districts.

* * *

In spite of the continued encroachment of electrical appliances upon the domain of gas utilization, the official statistics of the government for 1915 still show immense gains in volume and value of this product during last year.

* * *

The European war has caused a business activity in this country never before enjoyed, but at the same time there has been such a shortage of material for domestic consumption that it has been extremely difficult to keep up stocks of electrical supplies.

* * *

The fifteen million dollar bond issue just voted by the citizens of California for the perfection of their state highway system in which they have already invested eighteen million dollars should place this commonwealth among the foremost "good-roads" advocates in the world.

* * *

Professor E. C. Pickering, director of the astronomical observatory of Harvard College, brands the "daylight saving idea," by which clocks would be advanced one hour so that work would be begun earlier, as a measure of self-deception, a mere "trick to deceive the ignorant for a time."

* * *

Recent experiments of the U. S. Reclamation Service upon the effect of wind velocity on wave heights have brought out the interesting results that wind at thirty-five miles per hour produces wave heights of two feet, while a seventy-five mile per hour wind will produce a wave height of five feet.

* * *

The modification of the color tone produced by incandescent lamps has been under very serious consideration, first in the direction of the daylight lamp, with blue-tinted bulb, which gives a reasonably close approximation to white light in a very convenient and adaptable way, and at an efficiency rather better than has hitherto seemed likely.

* * *

The whole world still speculates as to what will happen after the war. Even in far off South Africa it is thought that orders for machinery and electrical appliances of all kinds are likely to assume vast proportions. The Rand is a continuous buyer of mining plant apparatus of every description, and there is no doubt that in the near future the new gold areas of the far eastern Rand will be clamoring for equipment.

* * *

An ultra-violet ray generator of an exceedingly efficient form is described in Peter Cooper Hewitt's patent No. 1,197,629. The efficiency of a vapor electric apparatus as a source of ultra-violet rays depends to a

great extent on the material of which the negative electrode is composed when its vapor serves to carry the current. By employing thallium or caesium in a vapor electric apparatus, a large proportion of rays having a wave length of 2000 to 4000 microns is found to be emitted.

* * *

The electric light has again wrought another wonder. A method of printing silk fabrics by color photography presents results which appear to be interesting in the sense that the process makes possible the production on silk fabrics of decorative effects the perfection of which does not seem to have been hitherto attained by printing. The method is of course borrowed from color photography, and consists in making three successive impressions—blue, yellow, and red—from three selected photographic prepared plates. The fabric is rendered sensitive by the aid of mixtures of alkaline phenols and diazo sulphites, products which possess the property of giving coloring matters only through the influence of light.

* * *

A method for removing foreign substances from the human body with the direct aid of Roentgen rays has been devised. The new method permits the surgeon to see the field of the operation with one eye, under ordinary conditions, while the other eye sees the same field under Roentgen-ray illumination. This method of double vision is made possible by the so-called "Grashey monocle," constructed by Dr. Grashey. The Roentgen machine itself is situated below the floor, in a room under the operating room, if necessary in a cellar, and is connected by means of a speaking tube with the operating room. The surgeon is enabled to see on the picture in the Roentgen machine how far his probe is removed from the object.

* * *

The first report of the special agent sent by the U. S. Department of Commerce to the Far East to investigate foreign markets for electrical goods sets forth the fact that although American manufacturers of electrical goods are now enjoying a period of exceptional prosperity, and are manifesting a commendable willingness to enlarge the scope of their activity through the acquisition of foreign business, they are, as a matter of fact, securing only a small percentage of the export trade that should properly be theirs. To insure an adequate and firmly rooted development in the future, two things are essential: First, the American makers must base their calculations on the obvious fact that many of their present orders from abroad are the result of the great dislocation in world economics produced by the European war. Second, they must strive diligently to adapt their output to the special desires of purchasers in distant lands; they must study with care and cultivate with discretion the vast foreign markets in which their endeavors should logically be rewarded by a gratifying and permanent success.

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POWER AND GAS

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The cost of money is the prime factor in determining whether a proposed water-power development is feasible. The initial investment is necessarily large because reservoirs, ditches, flumes, dams, generating equipment and transmission lines are costly. Engineers agree that the irreducible minimum in these construction costs has almost been reached. So that the chief hope for cheaper hydroelectric power is in lower interest rates.

Interest rates are dependent upon the risk involved. Most water-power developments involve two elements of risk—that associated with any public utility and that associated with any uncertainty of tenure.

There is a decided tendency to assign to governmental agencies all matters of a public nature, such as the service of electric light and power to householders. This is to be accomplished through the wholesale marketing of current to municipal distributors. It is quite probable that all small concerns will be eventually served through the direct agency of the municipality. This will leave the industrial field largely to private companies. Electrochemical plants, great irrigation projects and large railway electrification offer a wide field for power supply without the complexities of public service. Private capital can be obtained for such development at a lower rate than for public utilities.

But by far the most important element in the reduction of interest rates is an assured tenure of power sites—a security utterly lacking in the present laws governing power development on the public lands and on navigable streams. The chief objection to the present regulations is their indefiniteness of tenure. As a consequence, capital hesitates to take the risk and so seeks safer channels of investment.

Two fairly suitable bills were introduced in the Senate during the last session of Congress—the Shields bill providing for developments on navigable streams and the Myers bill dealing with the public lands. The Shields bill failed to pass the House and the Myers bill is the Senate substitute for the Ferris bill as passed by the House. Both are now in the hands of a conference committee which hopes to work out measures that will be passed by both branches of Congress during the next session.

The chief point of controversy over both bills is that they provide a definite fifty-year tenure, irrevocable except for breach of conditions. Furthermore each bill provides for an indeterminate permit after the expiration of fifty years. The present laws provide that the lease be terminated without compensation to the grantee and gives Congress power to revoke the grant at any time, also without compensation. The proposed bills protect the safety of the investment by providing that the government shall pay the owners for their property at the end of the granting period or if the act is repealed or amended before that time.

Without such protection and guarantee of tenure private capital cannot be induced to undertake water-power developments, as is amply demonstrated by the present stagnation. As the necessity for development is universally admitted, there seems no sane reason for further retardation. A definite tenure is

essential to stability of investment, stability of investment is a prerequisite to low interest rates, low interest rates must prevail if cheaper hydroelectric power is to be developed. The answer is obvious.

The low market price of lumber has, during recent years, forced the lumberman to study costs of production and analyze these costs to a minute degree.

Costs of Electric Logging

This analysis early brought to light the interesting and important fact that the average cost of logging operations comprises from thirty-five to fifty per cent of the total cost of logs delivered at the mill. Since the use of the time-honored steam donkey engine enters as a large factor in this cost, an investigation of the advisability of introducing the electrically operated donkey was early initiated.

This investigation has perhaps brought to light one of the most interesting comparative studies yet encountered in winning over the steam operated load to that of the method electrical. In this comparative study a clear line of demarkation is brought to light between the electric donkey as a scientific success and its accomplishments as an engineering success. Especially is this true if we define engineering as that branch of science that enables the human being to produce two dollars where before only one was seen to blossom.

From this latter viewpoint, a discussion to be found on another page of this issue brings out the important economic conclusion that the electrical donkey will handle logs at a saving over the best oil burning steam donkeys of some eighteen and two-thirds cents per thousand feet in board measure. And, where ordinary steam donkeys are brought into the discussion this saving is found to amount to over forty-five cents per thousand feet in board measure. These investigations were carried on for small logging camps. For the larger camp the saving should be even more pronounced.

There are many other features which favor the electrical method as opposed to the steam donkey that cannot so readily be placed into this dollar and cent comparison.

The danger from fire is materially lessened, since a large percentage of losses from fire in logging camps are traceable to the steam operated donkey. On the other hand the possibility of electric shock from the electric donkey is very remote and entirely negligible if all metal parts of the equipment are thoroughly grounded.

The question of control, too, is an important one. The electric donkey is easily operated with everything in the most convenient place for the operator. This reduces the fatigue of the operator, increases his control over the machine, and decreases materially the liability of accidents. Since, then, so many additional factors favor the electric donkey as opposed to its rival, the steam donkey, it would seem that, in every instance where a reasonable saving may from investigation be found to be probable under the adoption of the electrical method, no time should be lost by the management in changing over to this modern method of logging.

Preston, in his well-known writings of history, calls forceful attention to three leading factors that have throughout all ages held men and nations together; namely, community of race, community of religion and community of interest.

The present international war has conclusively demonstrated that the greatest of these factors is community of interest.

It must be admitted, then, that the upbuilding of commercial ties between neighboring countries which differ in race and religion largely depends upon the bond of community interest engendered by all parties to the issue.

South America and the Orient present opportunities to Western enterprise today so insignificant to what they will present on the morrow that all close observers familiar with their present gigantic proportions pause before even prophesying the possibilities of the morrow.

The question, then, is how to engender a firm and lasting community of interest with the neighbors that border the Pacific.

In England commercial scholarships are already being established to offer financial assistance to certain of her brightest and most capable young men as an inducement for them to travel and locate in a foreign country. These young men are to receive an annual stipend from the industry they represent and are to go into the foreign country with whom closer community of interest is desired and make a study of conditions there. They are to be given every assistance by the consular and diplomatic corps of the two countries concerned. They are to visit the various cities and attend courses of lectures with a strong commercial bias at universities and commercial institutions and in a hundred ways they will be enabled to acquire an intimate acquaintance with the country and with the habits and customs of the people. They will also be enabled to investigate the industries and to secure introductions to business men and to business centers. Applying this excellent example of British foresight to conditions of the West it is seen that the agricultural, industrial, engineering and commercial interests of the Pacific Coast states demand that the strongest community ties be built up between neighbors of the Pacific, especially those to the south. The time is now ripe, that chambers of commerce and other public spirited bodies should seriously consider founding similar commercial scholarships.

Let commercial scholarships be established, then, by these public spirited bodies and let our most brilliant and talented university students of the Pacific Coast compete for the honor and distinction of having a part in developing this community of interest with our neighbors of the Pacific.

The greatest commercial arena of history is to have its day upon the waters of the Pacific in the not far distant future and these young men will in after years vastly forward the wholesome community of interest that is so necessary.

PERSONALS

W. P. Hyatt, electrical contractor at Sacramento, was at San Francisco during the past week.

J. C. Hobrecht, electrical contractor of Sacramento, was at San Francisco during the past week.

B. C. Condit has resigned as chief engineer for the Northwestern Electric Company at Portland, Ore.

Jas. G. Pomeroy, manufacturers' agent of Los Angeles, was a recent business visitor at San Francisco.

A. G. Wishon, general manager of the San Joaquin Light & Power Company, was a recent visitor at San Francisco.

W. E. Sutherland, of the San Joaquin Light & Power Company, Fresno, spent a few days this week at San Francisco.

F. D. Fagan, Pacific Coast manager of the Edison Lamp Works, is making a months trip to Portland and the Northwest.

O. Laurgaard, consulting engineer at Portland, has been elected Multnomah County representative in the Oregon Legislature.

G. I. Kinney, of the General Electric Company at San Francisco, is serving as foreman of the federal grand jury at that city.

M. L. Joslyn, president of the Joslyn Manufacturing & Supply Company of Chicago, will be at Seattle for a few days next week.

N. M. Hope, formerly with the Turner Company of San Francisco, is now associated with the McFell Electric Company of San Francisco.

Hal Lauritzen, Holophane salesman with the Pacific States Electric Company, has returned from an extended business trip throughout the Northwest.

I. L. Capps, formerly with the Pacific States Electric Company, recently joined the sales force of the Studebaker Automobile Company at San Francisco.

C. G. A. Baker, vice-president and treasurer of the Baker-Joslyn Company of San Francisco, is making a two weeks' business trip in their Northwestern territory.

I. H. McCarty recently severed his connection with M. C. Baker & Son of San Francisco, to join **Louis E. Marsh** in handling The Specialty Shop of 82 Second street, San Francisco.

R. E. Fisher, commercial department of the Pacific Gas & Electric Company, has charge of the Christmas jinks to be held December 14th, for the Pacific Service Employees' Association.

W. G. Gordon, formerly with the Edison Lamp Works of the General Electric Company, has recently joined the sales force of the Pacific States Electric Company, in charge of the lamp department.

W. H. Bissell, manager of the Livermore Water & Light Company until taken over by the Pacific Gas & Electric Company, has opened a store as an electrical dealer and contractor at Livermore, California.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, who was recently operated on for appendicitis, is now spending a few weeks at Redwood City. He expects to be able to be at his office shortly.

R. P. Moore, formerly assistant superintendent of the Holton Power Company, has succeeded **C. E. Paris**, resigned, as general superintendent of the Holton Power Company and the Holton Inter-Urban Railway Company of El Centro, California.

C. E. Heise, San Francisco district manager of the Westinghouse Electric & Manufacturing Company, is making an extended trip throughout the East, and while there will attend

a Westinghouse jobbers' convention, which is to be held at Hot Springs, West Virginia.

C. E. Paris, for the past ten years general superintendent of all the public utility companies in the Imperial and Coachella Valleys, has resigned and accepted the position of manager of the Imperial Irrigation District, the largest irrigation system in the United States.

P. M. Downing, engineer in charge of maintenance and operation; **H. C. Vensano**, civil engineer, and **F. G. Baum**, consulting engineer for the Pacific Gas & Electric Company, are visiting the Halsey plant, which is nearing completion and is expected to be tied into the main system very shortly.

Paul B. McKee, assistant to the president, accompanied by **J. C. Thompson**, assistant to the secretary, of the California-Oregon Power Company, have returned to San Francisco from a trip over the entire system, and report 12 inches of snow on the tops of the Siskiyou. They also stated that construction is being started on a 7½-mile line from Hornbrook to Hilt, in Siskiyou County. They are using ¾-inch common galvanized guy cable for their line on account of high cost of copper. The California-Oregon Power Company is now in new offices at No. 129 Leidesdorff street, San Francisco.

MEETING NOTICES.

Pacific Service N. E. L. A. Section.

The regular monthly meeting of the section was held November 14 at Ellis Hall, San Francisco, under the auspices of the electric distribution department of the Pacific Gas & Electric Company. **S. V. Walton** explained the purpose and plans for America's Electrical Week. **S. J. Lisberger**, **C. A. Gaines** and **W. A. Hillebrand** presented demonstrations and experiments illustrating the fundamental principles of electricity, showing how it is generated, how transformed, how measured and how made to perform useful work. Music was rendered by the Pacific Service Glee Club.

Los Angeles Section, A. I. E. E.

The opening meeting of the season, under the chairmanship of **R. H. Manahan**, was held at 6:15 p. m., November 14 at Christopher's Cafe. Following the dinner several papers covering developments of the past year in the electrical industry under the general subject, "Where Are We at Electrical?" in accordance with the following program:

"K. W. Hot and Cold," **E. E. Valk** Engineer General Electric Company; "Juice En Transit," **Prof. R. W. Sorenson**, Throop College of Technology; "Transportation," (Not Jitney), **Julian Adams**, Assistant Electrical Superintendent Pacific Electric Railway; "H. P. A la Motor," **C. P. Walker**, Engineer Westinghouse Company; "Hello Stuff," **L. A. Vary**, Equipment Engineer P. T. T. Company; "Candle-Power De Luxe" **W. D'Arcy Ryan** (He put the Lighting Rods on the Exposition), Illuminating Engineer General Electric Company; "Electrocutioner," **Geo. Damon**, Dean Throop College of Technology.

The officers for the ensuing year are: **R. H. Manahan**, chairman; **Carl E. Johnson**, secretary; **J. M. Barker**, assistant secretary; **J. A. Lighthipe**, **Edw. Woodbury**, **R. A. Morehead** and **F. W. Harris**, directors; **H. A. Barre**, chairman of papers committee; **C. G. Pyle**, chairman of entertainment committee, and **Carl A. Heinze**, chairman of membership committee.

Great Western Power Company Bay Section N. E. L. A.

At the regular monthly meeting held in the Commercial Club rooms, Oakland, November 13th, **W. S. Leffler** of the Electric Sales Service Company read an interesting paper on "Electric Water Heating," which will appear in these columns at an early date. **A. H. Halloran**, managing editor of the Journal of Electricity and Pacific Coast representative of the Society for Electrical Development, explained the significance

of America's Electrical Week. John Hood, local engineer with the General Electric Company, showed a movie film, "The King of the Rails," and presented facts regarding the electrification of the Chicago, Milwaukee & St. Paul Railway. This triple-barreled program entertained and instructed the members till a late hour, when refreshments were served.

San Francisco Electrical Development and Jovian League.

M. H. de Young, editor of the San Francisco Chronicle, was the guest of honor at the League luncheon on November 8th. Geo. C. Holberton, as chairman of the day, delegated Fred Myrtle to introduce Mr. de Young. Mr. Myrtle stated that Mr. de Young's hobby was Golden Gate Park and that he would speak specifically regarding the Memorial Museum. In a most interesting address Mr. de Young then recounted his early experiences as a collector and the gradual growth of the remarkable collections in the museum. He exhibited the plans for the new museum which he is to build in the park. N. J. Prendergast, chairman of the entertainment committee provided high class entertainment for the occasion by Violet and Ruth Sebastian, graceful dancers, and by Harold Jacobs, who proved his art as a magician.

The Bi-Monthly Luncheon of the Portland A. I. E. E., N.E.L.A. and the Oregon Society of Engineers.

The regular luncheon in the orange room of the Oregon Hotel on Wednesday, November 8, 1916, was under the auspices of the Oregon Society of Engineers. Mr. W. S. Turner, president of the Oregon Society of Engineers, presided as chairman. The first speaker of the day was Mr. Fred P. Henshaw of the N. S. G. S., who spoke on "Hydrometric Work in Oregon." The other speaker of the day was Mr. N. G. Pike, president of the Portland Rotary Club and he spoke on the subject of "Unity of Purpose." Mr. Pike made a strong plea for the universal brotherhood of men, especially in their various local organizations. The individuals should get closer together and have more charity for the other fellow's faults and failures.

Fifty-nine members were present at the meeting.

Los Angeles Jovian Electric League.

"Trade Conditions in South America" was the subject of an interesting address given before the League at their regular weekly luncheon, Wednesday, November 8th, by Seward C. Simons, secretary of the Municipal League of Los Angeles. He stated that due to the interruption of the European war, we are getting a portion of the large potential trade of South America, and answering the question as to why we have not had this business in the past, made the following comments:

"We have not realized that we must know a people and its characteristics, before we can build up a friendship, and we must build up friendship before we can build up trade.

"We must know the language of the country, Spanish, for all the nations, except Brazil and Uruguay, which speak Portuguese. Foreign trade must be on a reciprocal basis. Up to the present time, Argentine and other South American countries, have been producing the same articles of commerce as the United States. They had nothing to trade with. Trade follows capital. At the opening of the present war, England had \$1,000,000,000 in Argentine Republic, alone; the United States, \$5,000,000. It is hard for an American salesman to 'land' an order from the British directorate. We had practically no ships of our own; 60 per cent of the vessels leaving Buenos Ayres, were British. Whereas, the English merchant was willing to buy anything and everything which the South American had to sell, the American only sought a single product, such as grain or beef. While foreign merchants had banking assistance, we have only just now established branch banks. We have been unwilling to take the time and patience to win the regard of the Spanish-American peoples.

We have disregarded instructions as to packing, shipping and preparing articles for export. We have forgotten that the South American is sensitive, proud of his nation, resents our attitude of superiority, and fears our national ambitions."

UTILITIES CONFERENCE IN WASHINGTON.

Practically every electric and power company and every large city in the state of Washington were represented at the electric conference, which was given over to the consideration of proposed changes in electric, gas and water rules.

Representatives of electrical workers introduced at the conference held this week relative to the proposed revision of electric, gas and water rules by the public service commission, a set of amendments to the overhead construction rules, all of them being designed to make overhead construction safer. No definite action was taken by the commission, for, owing to a misunderstanding other representatives before the commission had not prepared any proposed changes in overhead construction rules, but had come prepared only to discuss the tentative general rules governing service. The general rules were informally discussed, after which the commission adjourned to meet in Seattle December 5th for further consideration of the problems.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

Although the commission finds that the Western States Gas & Electric Company does not earn in its Eureka division 6 per cent on its gas and electric properties, it has determined, after a discussion with the company officials, that the only thing to do is to reduce the rates instead of raising them. The commission says the problem which the company seeks to solve cannot be solved by increasing its rates, "as such increase could not be justified by the worth of the service to the consumer, and if attempted would probably decrease the company's gross revenue. The only solution is an attractive rate to customers and the reduction of electric production expenses." An order establishing a schedule of reduced rates has been issued by the commission.

The Pacific Gas & Electric Company has presented its application for authority to use \$2,250,000 derived out of the proceeds of the sale of stocks and bonds authorized by the commission last January. The money is to be used for extensions, additions and betterments in the various departments of its system. The largest part, or about \$1,850,000, is for construction of its hydroelectric plant on the South Yuba River. The balance is for miscellaneous improvements. The company reported that up to September 1st it had sold of the authorized securities all of the bonds and 9939 shares of stock at an average price of \$91.62 per share, amounting to \$910,697.50. On the South Yuba plant \$818,535 has been spent, and \$1,031,464.19 is to be spent.

The Southern California Edison Company has petitioned the commission for an order determining that the commission's findings as to the just compensation to be paid by the city of Los Angeles for the company's plant in that city shall no longer be of any force. On September 6th the commission fixed the compensation to be paid to the Southern California Edison Company for its distribution system sought to be taken under eminent domain proceedings at \$6,328,000. The petition says that the city of Los Angeles has taken no steps to act upon the decision of the commission and that more than sixty days have elapsed since its filing. Therefore, the petition says, the city, having failed to comply with the public utilities act, the commission's order finding the amount to be paid should be declared void. The company vigorously opposed the finding of the commission, asserting that the proper price to pay for its properties was at least \$20,000,000.



NEWS NOTES



INCORPORATIONS.

NORTH YAKIMA, WASH.—The Union Land & Power Company has filed articles of incorporation. Capital \$100,000, by M. Velikanje, M. A. Freidlin, G. D. Foster, F. E. Moxley and W. D. McNair.

RENO, NEV.—Articles of incorporation have been filed by the Patterson Water Company, a new land and irrigation corporation, with a capital stock of \$10,000, divided into 10,000 shares at a par value of \$1 each; headquarters are at 230 N. Virginia street. W. H. Patterson of Cedarville, Cal., and Robert Richards and S. Summerfield of Reno, are the incorporators and directors.

BUTTE, MONT.—Articles of incorporation have been filed by the Intermountain Power Company. The object of the corporation is to develop water power in Montana and other states, and to sell the power so developed. The principal office is to be in Butte and the life of the corporation is fixed at 40 years. The capital stock is \$500,000 in 5000 shares of \$100 each. The incorporators are C. F. Kelley, Charles J. Kelly, John Gillie, L. O. Evans and Eugene Carroll. Directors of the new company stated that plans are not in shape for a more detailed announcement of the plans and prospects of the concern. The location of the power sites was not announced.

ILLUMINATION.

POPUAR, MONT.—This place has voted bonds to the extent of \$6500 for the construction of a municipal lighting plant.

POCATELLO, IDAHO.—The Pocatello Electric Company was awarded the contract for the work in lighting district No. 20, including light posts and other equipment, at \$51,513.73.

WHITTIER, CAL.—A resolution ordering the installation of lighting posts along Philadelphia street, has been adopted by the city council.

CLE ELUM, WASH.—Sonth Cle Elum has let the contract for its new electric lighting system to C. H. E. Williams of Seattle, whose bid was \$4070.

NORDHOFF, CAL.—Arrangements have been made for lighting the streets of the business section of the town by the Ojai Valley Mine League.

KINGMAN, ARIZ.—The Wallapai Light & Power Company has been refused a certificate of convenience and necessity to operate an electric plant in the town of Chloride.

BOISE, IDAHO.—Bids are being received by the city clerk for the construction of a lighting system in local lighting district No. 2, according to plans on file with the city engineer.

SAN PEDRO, CAL.—Bids for the electric installations for Shed 152 have been received by the board of harbor commissioners. The J. M. Mullins Company was the lowest bidder at \$2315.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to November 27, for furnishing lighting fixtures for the hall of records, in accordance with plans and specifications on file in the office of the board.

CALEXICO, CAL.—The Imperial Valley Gas Company is planning to establish a plant here in the near future. It is probable that the company will lay gas mains in alleys here and have them completed before the proposed paving is put down.

LOS ANGELES, CAL.—The city council has passed an ordinance calling for the installation of the necessary appli-

ances and electric current to be furnished for one year for lighting of Hobart boulevard between Washington street and Adams street.

CHLORIDE, ARIZ.—The Desert Power Company has made an offer to furnish street lights for Chloride. The rate asked for ten 250 watt street lamps placed along Tennessee avenue with a couple of small lights on Second, is \$2.50 per month per lamp. It is probable that sufficient funds will be raised for the purpose.

PORTLAND, ORE.—The board of county commissioners has awarded the lighting contracts on the interstate bridge as follows: Lamp posts and brackets, Pacific States Electric Company, \$1538; wiring and copper conductors, U. S. Steel Products Company, \$8472.40; transformers and time switches, Pacific States Electric Company, \$1714.32.

CENTRALIA, WASH.—At a recent meeting, the stockholders of the Centralia and Chehalis Gas Company, the properties of which were taken over a year ago by the North Pacific Public Service Company, voted to dissolve the corporation. In accordance with this action, a petition was filed in the Pierce County Superior Court by W. W. Seymour, president.

TELEPHONE AND TELEGRAPH.

STANWOOD, WASH.—An ordinance has been passed granting a franchise to the People's Telephone Company.

SEDRO WOOLLEY, WASH.—The Skagit Valley Telephone Company has asked for a 50 year franchise in this city.

OKANOGAN, WASH.—According to C. C. Crandall, the Pacific Telephone & Telegraph Company will make further improvements to its system in Okanogan county.

STANWOOD, WASH.—Stanwood has granted a franchise to the Peoples Telephone Company to construct lines for the transmission of electricity and for telephone purposes.

HILLSBOROUGH, CAL.—The Pacific Telephone & Telegraph Company has been granted permission to erect a building at the intersection of Floribunda avenue and the State Highway.

NENANA, ALASKA.—The United States government is requesting bids for the construction of a signal corps station at this place. Plans and specifications are on file at Fairbanks telegraph office.

BURNS, ORE.—It has been suggested that steps be taken to connect this place with Bend by telephone. The cost would be about \$12,000. J. E. Weston, manager Intermountain Telephone & Telegraph Company at this place, made the suggestion to the Commercial Club of Bend.

OAKDALE, CAL.—Announcement has been made of a number of extensive improvements by the telephone company. Included in the improvements is the construction of a new trunk line from Oakdale to Modesto. Cost of the construction is given at \$10,000.

HONOLULU, T. H.—The Marconi Wireless Telegraph Company has announced that it is ready to inaugurate regular wireless service between here and Japan. Company officials declare this the longest wireless commercial service ever operated. It will enable San Francisco to transact business by wireless with Japan, relaying messages here.

TRANSMISSION.

COLFAX, WASH.—The Commercial Club has taken up the question of securing a heating plant for the city.

VALLEJO, CAL.—The Pacific Gas & Electric Company has applied for permission to install a cable across Mare Island straits.

REDDING, CAL.—The Northern-California Power Company has a crew extending its line from Lewiston to Weaver-ville, a distance of eight miles.

TACOMA, WASH.—The Tacoma District Heating Com-pany expects to be at work in 30 days laying pipes in the district by Ninth and Thirteenth streets.

ANACORTES, WASH.—The city council recently passed a resolution inviting the Puget Sound Traction, Light & Power Company to extend its light and power lines to this place.

TACOMA, WASH.—The Tacoma District Heating Com-pany contemplates having in operation by January 1st a 1040 h.p. steam heating plant for furnishing heat to business and office buildings.

PENTICTON, B. C.—The purchase of 12 5 ampere watt hour meters has been authorized by the council, also 2 10 ampere watt hour meters. The purchase of a Diesel engine to cost about \$25,000, is also being considered.

SEATTLE, WASH.—An ordinance has been introduced in the city council providing for the condemnation of land and other property for a steam electric power plant site along side of the present plant on the east shore of Lake Union.

COLTON, CAL.—The Fontana Power Company has com-menced construction of a 36 in. concrete pipe line to convey water from the plant soon to be erected to the Fontana tract. Contracts have also been closed for the purchase of the steel pipe line for carrying water four and one-half miles from the mouth of the canyon to the plant. For the plant proper 300 additional tons of steel will be necessary. The plant will have a capacity of 1800 kilowatts or about 2400 h.p.

TRANSPORTATION.

EUREKA, CAL.—The Humboldt Transit Company will voluntarily forfeit its franchise for operating electric cars on T street.

SACRAMENTO, CAL.—A large force of men has been put to work on Twenty-fourth street by the Pacific Gas & Elec-tric Company preparatory to laying double tracks.

HONOLULU, T. H.—The board of directors of the Hono-lulu Rapid Transit Company has authorized the construction of a new two-mile line from Liliha street, along School street to Kalihi Road and the sale of \$400,000 stock to the present stockholders to cover other minor extensions.

PRESTON, IDAHO.—According to C. G. Haynes of Black-foot the project of the Pocatello Traction & Interurban Com-pany to build an electric road north from here to the Yellow-stone is assured.

SEATTLE, WASH.—The city council and the Seattle & Rainier Valley Railway Company have reached an agreement whereby the company will upon being relieved of certain franchise obligations spend \$10,000 in improvements resulting in a gain of ten minutes in time of running between Seattle and Renton.

IRRIGATION.

EVERETT, WASH.—D. R. Keys and C. R. Riddle filed notice of appropriation of water in Glacier Creek.

COUER d'ALENE, IDAHO.—The county surveyor, Neil S. Coventry, is aiding in the formation of a drainage district near St. Joe.

TERRA BELLA, CAL.—Six water bearing strata have been encountered by the rotary well rig in the employ of the Terra Bella irrigation district.

MEDFORD, ORE.—The petition for the irrigation district in the Footh Creek district will be heard by the commission-ers on November 9. It will embrace about 1200 acres.

MALTA, MONT.—Booth & Krips, of Saco, Mont., have

the contract for the construction of structures on the Nelson River reservoir, South Canal Milk River project at \$28,384.

WOODLAND, CAL.—W. L. Wales has been awarded a contract to build an irrigation system for the Houey Lake Valley Irrigation District in Lassen county. The district embraces 33,000 acres.

PRINEVILLE, ORE.—The electors of the Ochoco irriga-tion district will vote November 11 on the proposed issue of \$1,000,000 in bonds for the construction of a dam six miles above here on the Ochoco, sufficient to irrigate 23,000 acres of land.

AUBURN, CAL.—The Pacific Gas & Electric Company is filing actions against several people with whom it has been unable to reach satisfactory agreements as to rights of way for the ditches and tunnel it was ordered to build in order to supply water for irrigation around Newcastle.

SEQUIN, WASH.—The bond election recently held here resulted in the Happy Valley Irrigation District authorizing bonds to the extent of \$80,000. The district will proceed with the construction of an irrigation canal from Dungenness River to cover 6000 acres of land just south of here.

SUSANVILLE, CAL.—Leon Bly of San Francisco has made application to the United States Land Office here for right of way for a ditch from Eagle Lake. Mr. Bly proposes to appropriate 30,000 acre feet of the waters of that lake for the irrigation of in the neighborhood of 20,000 acres of land in Honey Lake Valley.

SANTA BARBARA CAL.—For the purpose of irrigating the Hart tract in Montecito, which has been recently pur-chased by Mrs. C. B. Raymond, a million gallon reservoir is being erected, work being done under the direction of F. F. Flournoy, a six-inch main is being laid from Romers canyon to carry the water to the reservoir.

MARYSVILLE, CAL.—The Farm Land & Investment Com-pany has applied to the state water commission for permis-sion to appropriate 100 cubic feet per second of the waters of the Yuba and Feather rivers for the culture of rice. The proposed diversion is to be by means of centrifugal pumps, electrically driven. There are 5500 acres to be watered and the estimated cost of the system is \$31,000.

EL CENTRO, CAL.—It has been suggested that \$15,000,-000 be raised for improvement work in Imperial Irrigation District, to be expended as follows: \$3,000,000 for building Laguna dam, \$3,000,000 to pay off the irrigation district bonded indebtedness, \$2,000,000 in building the canal and connecting up with Laguna dam, \$2,000,000, for electric and water power plants and distributing lines, \$2,000,000 in building main canals and distributory canal system.

SACRAMENTO, CAL.—Preliminary steps have been taken for the establishment of a Wright irrigation district for Fair Oaks and vicinity. Petitions have been circulated and the necessary number of acres secured. The number of acres to be irrigated is 3600 and it is estimated that the entire cost of the new system will be \$125,000. The property owners are divided in the opinion as to the advisability of buying the old pipes and system or building a new one throughout. The petition will be presented to the super-visors at the December meeting.

DIXON, CAL.—Engineer Hawley has pronounced the res-ervoir sites of Devil's Gate, Guenoc and Devil's Head as feasi-ble sites and the watershed ample for the irrigation of 55,000 acres by development of two of the three sites. J. H. Peter-son, local rancher, favored further consultation with the Yolo Water & Power Company, with a view to getting canals run into northern Solano county, and favored a gravity system dis-trict if the present land holders would be benefited. W. J. Weland urged still further investigation and pleaded for con-sideration of a proposition he believes will greatly develop the latent possibilities of the land of this part of the county.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

- | | |
|---|--|
| A-1 American Ever-Ready Works of National Carbon Co.
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco. |
| B-1 Baker-Joslyn Company.....
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco. | N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco. |
| C-1 Century Electric Co.....
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore. | N-3 National Lamp Works of G. E. Co.....
(All Jobbers.) |
| C-3 Crocker-Wheeler Co.....
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles. | N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles. | N-6 National Carbon Co.....
Cleveland, Ohio. |
| D-4 Davis Slate & Manufacturing Co.....
Chicago, Ill. | O-1 Okonite Co. (The).....
(All Jobbers.) |
| D-2 Dearborn Chemical Company.....
355 East Second St., Los Angeles; 301 Front St., San Francisco. | P-2 Pacific States Electric Co.....
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle. |
| E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles. | P-4 Pelton Water Wheel Co.....
2219 Harrison St., San Francisco. |
| E-2 Edison Storage Battery Co.....
206-S-10 First St., (near Howard), San Francisco. | P-5 Pierson, Roeding & Co.....
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle. |
| E-3 Electric Agencies Co.....
279-283 Minna St., San Francisco; 419-421 E. Third St., Los Angeles. | P-7 Pittsburgh Piping & Equipment Co.....
Monadnock Bldg., San Francisco. |
| E-4 Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco. | S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco. |
| E-5 Electric, Railway & Manufacturing Supply Co.....
34 Second St., San Francisco. | S-4 Southern Pacific Co.....
Flood Bldg., San Francisco. |
| E-6 Electric Novelty Works.....
533 Mission St., San Francisco. | S-5 Sprague Electric Works.....
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane. |
| E-7 Economy Fuse & Mfg. Co.....
Kinzle and Orleans Sts., Chicago. | S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815 Newhouse Bldg., Salt Lake City, Utah. |
| F-3 Federal Sign System (Electric).....
618 Mission St., San Francisco. | T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives. |
| G-1 General Electric Co.....
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane. | T-2 Tubular Woven Fabric Company.....
Pawtucket, R. I. |
| H-1 Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.) | U-1 United Sheet Metal Works.....
575 Howard St., San Francisco. |
| H-2 Hemingray Glass Co.....
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco. | W-1 Wagner Electric Manufacturing Company.....
St. Louis, Mo. |
| H-3 Haller-Cunningham Electric Co.....
428 Market St., San Francisco. | W-2 Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore. |
| H-4 Hubbard & Co.....
(See Pacific States Elec. Co.) | W-3 Ward-Leonard Electric Co.....
Mt. Vernon, New York. |
| H-7 Hurley Machine Co.....
New York and Chicago. (See Pacific States Electric Co.) | W-4 Westinghouse Electric & Manufacturing Co.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; First National Bank Bldg., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane. |
| I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles. | W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.) |
| I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco. | W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles. |
| L-1 Leahy Manufacturing Co.....
Eighth and Alameda St., Los Angeles. | |
| L-2 Locke Insulator Manufacturing Co.....
(See Pierson, Roeding & Co.) | |
| M-2 McGlaulin Manufacturing Co.....
San Rafael, Cal. | |
| M-3 Moore & Co., Charles C.....
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson. | |

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, NOVEMBER 25, 1916

PER COPY, 25 CENTS

THE RUSH CREEK CONTROVERSY.

BY C. C. HOGAN.

ANALYSIS OF VARIOUS TYPES OF IRRIGATION PUMPS.

BY R. H. CATES.

THE INSTALLATION OF ELECTRIC HEATING APPARATUS.

BY E. A. WILCOX.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries

Edison Storage Battery Co.

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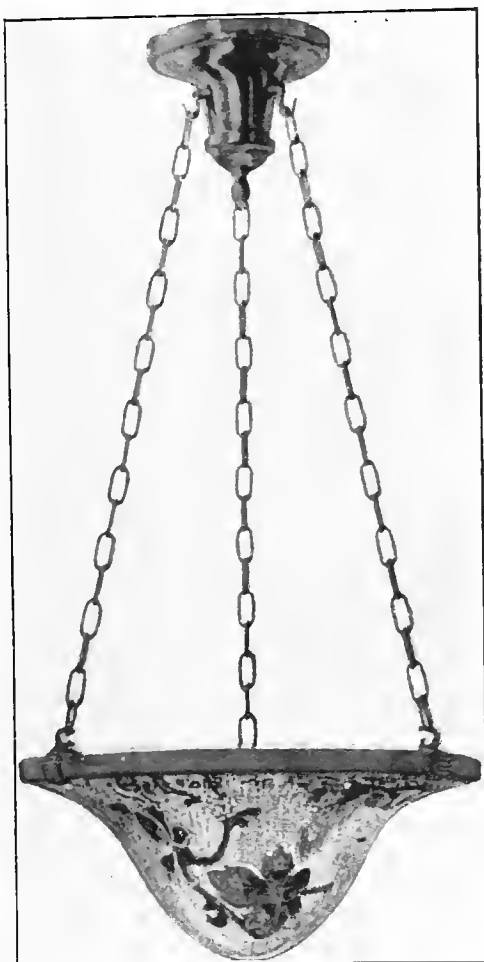
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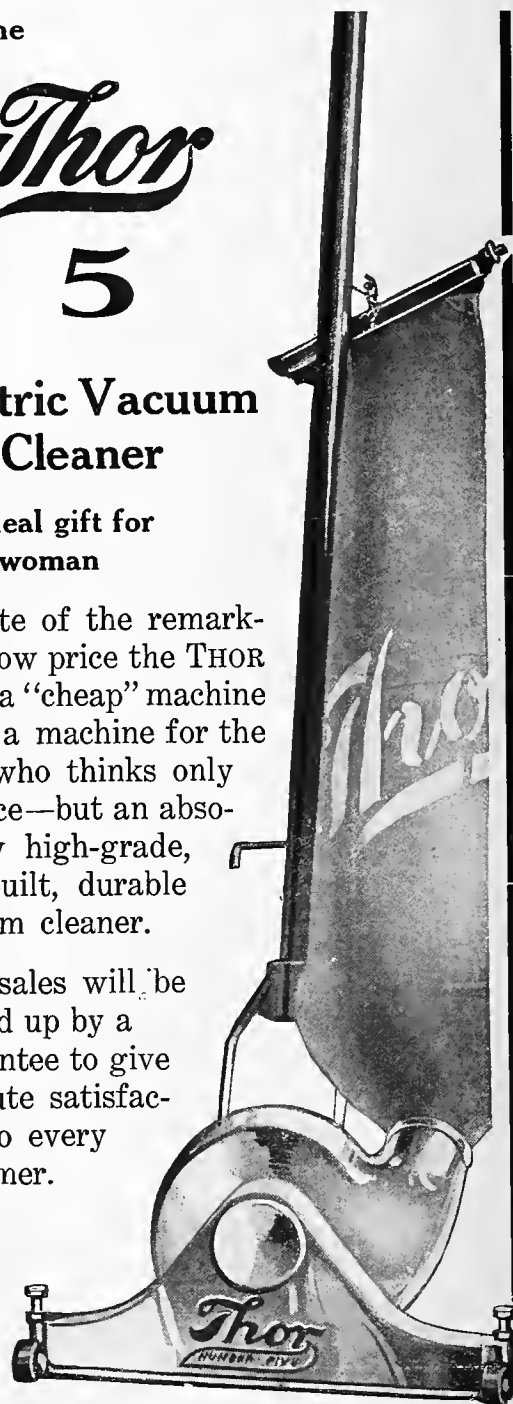
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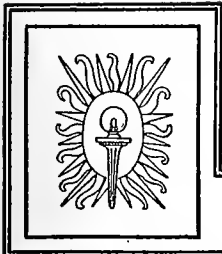
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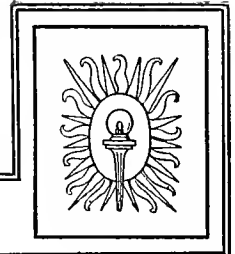
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JOURNAL OF ELECTRICITY

POWER AND GAS



Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXVII

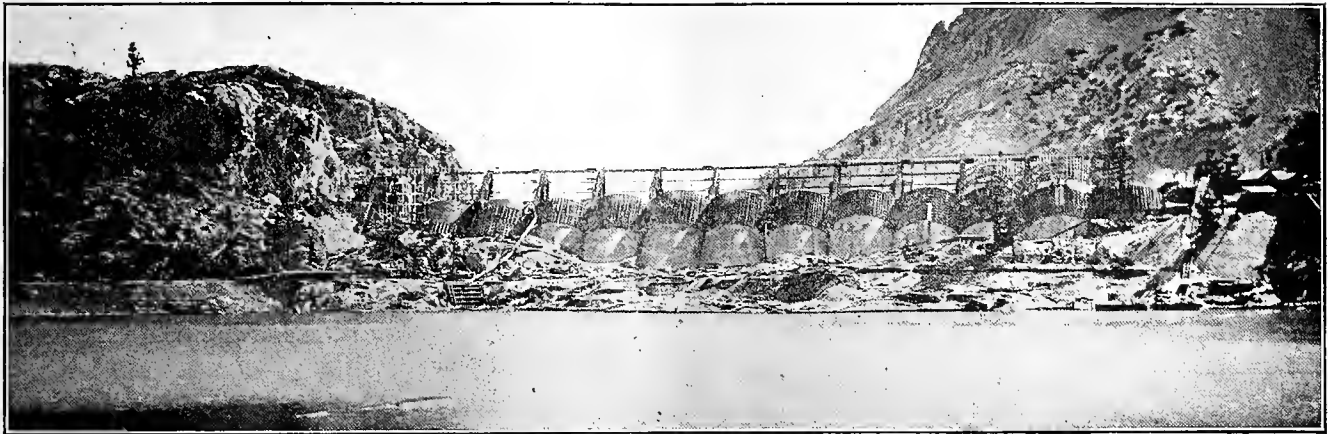
SAN FRANCISCO, NOVEMBER 25, 1916

NUMBER 22

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THE RUSH CREEK CONTROVERSY

BY C. C. HOGAN.



The Agnew Lake Dam of The Rush Creek Development.

Power developments of the Pacific Power Corporation on Rush and Lee Vining creeks in Mono County, are being attacked ostensibly because of the injury such developments would inflict on some beautiful scenery connected with certain water falls high up in the Sierras on those creeks. These attacks are taking the form of newspaper and magazine articles glowing with righteous protestation against the destruction by the "Power trust" of Silver Lake and Lee Vining Falls, which, it is asserted, will deprive tourists of the enjoyment of "scenic beauties."

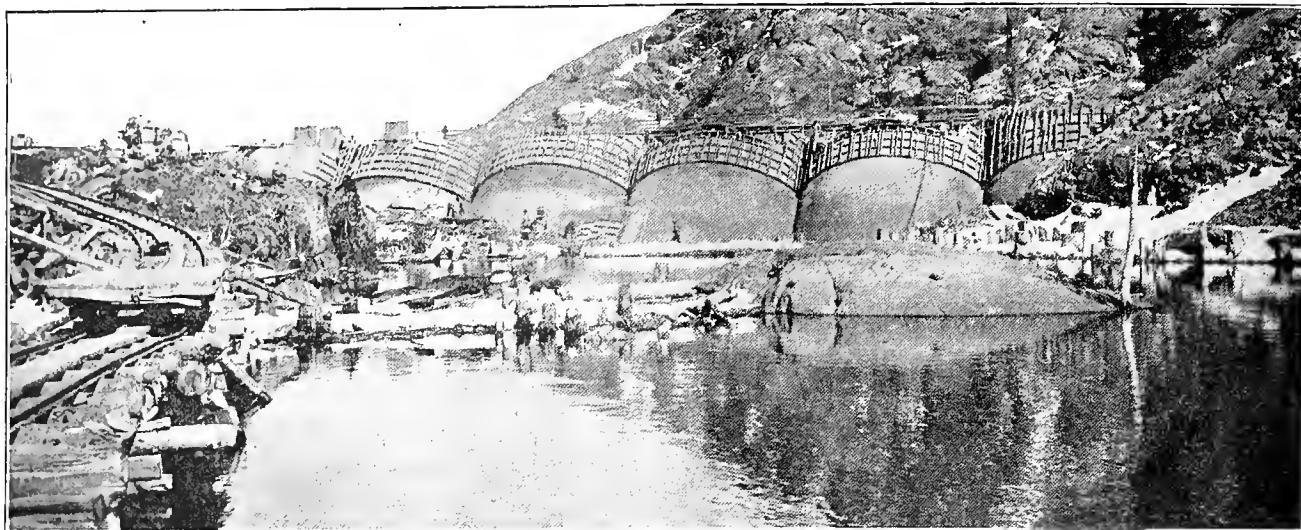
It is claimed by the officers of the power company that the real motive back of these attacks lies deeper than a patriotic desire to preserve the scenery,—that they are but a continuation of long drawn out controversy and litigation with certain interests headed by Wallis D. McPherson, who appears to be leading the "scenic beauty" propaganda. These interests, it would appear, sought to

secure for themselves the identical water rights now being utilized by the Pacific Power Corporation, but being defeated in the courts and before the State Water Commission, it is alleged they now seek by an appeal to public sentiment to prevent others from using the waters in the same way they wanted to use it.



Rush Creek Falls.

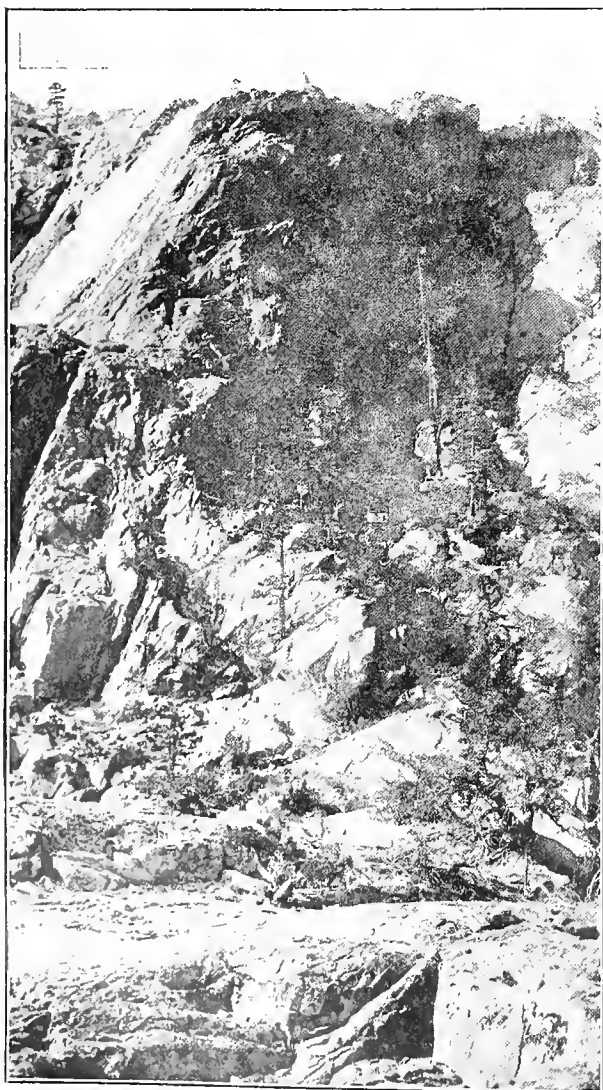
The history of the controversy and the lengthy litigation that has resulted, dates back several years, long before the wilds of Mono County were ever thought of as a beauty spot, and it is asserted by the power company that but for its pioneering in opening up the country and the construction by it at enormous expense of highways through the mountains, some of the falls in controversy would never have given their beauty to the aesthetic gaze of admiring tourists, but would have remained forever hidden away among the rugged fastnesses of the high Sierras and incidentally the electric energy which, when properly harnessed, they are



The Gem Lake Dam.

capable of generating, would likewise be forever denied for the use of mankind.

The power developments of the Pacific Power Corporation are being made by virtue of certain agreements made with the owners of the waters of Rush and Lee Vining creeks, and permits granted by the State Water Commission.



Precipitous Country Near Rush Creek Falls.

For years the inhabitants of the arid region in Mono Basin below Silver Lake and Lee Vining Falls have used the natural flow of those streams for the necessary irrigation of their lands. Conditions there were similar to other sections of the state in that without proper impounding of the waters and regulation of the stream flow, the irrigators were unable to get the full benefit of the water when most needed.

In 1902 a project was started by the incorporators of the California-Nevada Canal, Water & Power Company whereby the waters of Rush Creek were to be dammed at Agnew and Gem lakes, the waters conveyed therefrom through flumes and ditches upon the lands below for the benefit of the land owners. Application was shortly thereafter made by the canal company to the Interior Department for an easement over the government land at the damsites. The whole project was, after due investigation, given the sanction and approval of the Secretary of the Interior, with the proviso that the canal company would permit the use of the impounded waters for power, should a power applicant appear,—the contention of the government being that the location favored the development of power in addition to the irrigation benefits. Subsequently, the Pacific Power Corporation, entered into an agreement with the canal company by which the power company was given the power right in accordance with the terms of the government's stipulation.

When the canal company first started surveys for its ditches, McPherson was employed as rodman with the surveying party. Foreseeing the possibilities of the project, and, so it is claimed by his erstwhile employers, desiring to tie up the waters for himself, while still in their employ, he posted a notice of appropriation and thereafter other notices on Rush Creek for a total of 101,500 inches. The first appropriation was made in 1910, notwithstanding the fact, it is asserted, that there were no surplus waters subject to appropriation at those times.

Subsequently he was instrumental in organizing the Mono Valley Improvement Company and the Rush Creek Mutual Ditch Company. The improvement company started an active advertising campaign to

induce settlers to locate upon desert land adjacent to the proposed ditches of the ditch company, under conditions that would compel them to purchase water stock in the ditch company. The company claimed

the rapidly increasing demands for power in the territory served.

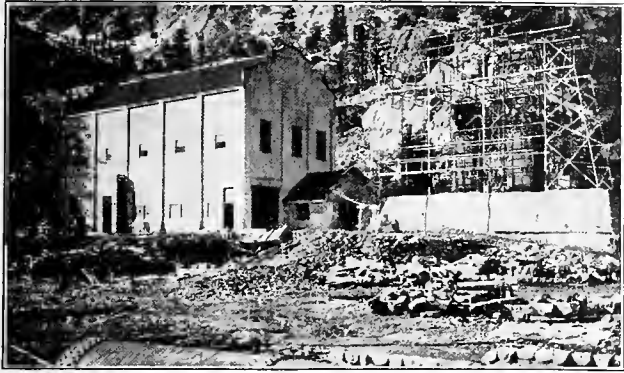
TO SELECT MEN FOR STUDY OF FOREIGN MARKETS.

Markets for American goods in many countries are to be studied by men to be selected as a result of an examination which is to be given in the principal cities of the country by the United States Civil Service Commission on December 6th. The persons chosen are to act as trade commissioners and special agents for the Bureau of Foreign and Domestic Commerce. Their work is considered an important step in preparing the country to retain and expand its newly won foreign markets.

Ten appointments are to be made for the following investigations: Motor vehicles in Russia and the Far East; investment opportunities in Russia; fancy groceries in South America; furniture in South America; metal-working machinery and prime movers in Russia; metal-working machinery and prime movers in Brazil; jewelry and silverware in South America; hardware in Africa, the Near East, and India; ports and transportation facilities in Russia and the Far East, and mineral resources in the Far East.

The duties of appointees to these positions will be to obtain information concerning the demand in foreign markets for the particular commercial lines they are to study and to present the data obtained in straightforward, readable reports, which will enable American manufacturers and exporters to plan campaigns for the sale of goods in the markets investigated. Applicants for the South American investigations will be expected to know Spanish, and extra credit will be given for Portuguese. For work in Brazil, Portuguese is considered especially desirable. In the investigations including Russia, French is required, and an extra credit is given for Russian. No foreign language is required for the hardware investigation in Africa, the Near East, and India, or for the investigation of mineral resources in the Far East. No person will be admitted to any of these examinations who has not had previous training which would qualify him as an expert in the particular line to be investigated. This means substantial and responsible experience. An oral test will be given at Washington or some other city before final appointments are made, and only those who pass successfully the written examination on December 6th will be asked to present themselves.

The bureau will pay each of these men a salary not to exceed \$10 a day, with all transportation expenses paid and \$4 a day extra for subsistence. Persons who meet the requirements and desire this examination should at once apply for Form 375, stating the title of the examination for which the form is desired, to the United States Civil Service Commission, Washington, D. C.; the secretary of the United States Civil Service Board, post office, Boston, Mass., Philadelphia, Pa., Atlanta, Ga., Cincinnati, Ohio, Chicago, Ill., St. Paul, Minn., Seattle, Wash., San Francisco, Cal.; customhouse, New York, N. Y., New Orleans, La., or old customhouse, St. Louis, Mo. Applications should be properly executed and filed with the commission at Washington in time to arrange for the examination.



The Rush Creek Power House.

in its circular to control 30,000 inches of water on Rush Creek. By this means, it is asserted McPherson hoped to realize upon the questionable water locations made by him. The advertising campaign brought in a number of entrymen and it is asserted that as high as \$40 per share was paid by some of them for stock in the ditch company. In order to show some semblance of good faith the ditch company commenced the construction of ditches with machinery, it is asserted, that was never paid for. In 1914, an attempt was made by McPherson's companies to make a connection with Rush Creek by constructing a ditch upon lands which they did not own, and for which no right of way had been secured. Suit was brought to enjoin this trespass and an injunction was granted. The ranchers, land owners and bona fide appropriators were then roused to action against what appeared to them as an attempted encroachment on their long established rights by McPherson and suit was instituted in the Superior Court of Mono County to secure an adjudication of the respective water rights, Judge Hancock of Calaveras County was appointed by Governor Johnson to try the case.

A decision just rendered excluded the supposed rights of McPherson and his companies, the Court finding, in effect, that the prior rights of the original bona fide appropriators and land owners take the entire flow of the stream; and therefore in 1910 at the time McPherson made his filings, there were no waters of Rush Creek subject to appropriation.

The Pacific Power Corporation is a great power system and with its connecting transmission lines, serves a large and rapidly growing section of the state, and also the mining districts of Nevada. The territory served extends from Mono County southward, a distance of over five hundred miles to the Imperial Valley and eastward into Nevada, a distance of one hundred and fifty miles to the Goldfield-Tonopah, Aurora, Wonder and Fairview districts.

The organization has invested millions of dollars in improvements and has been instrumental in developing large tracts of arid lands, mines and industries. Millions of dollars has been added to the state's taxable wealth, and our citizens have received the benefit of much needed service rendered.

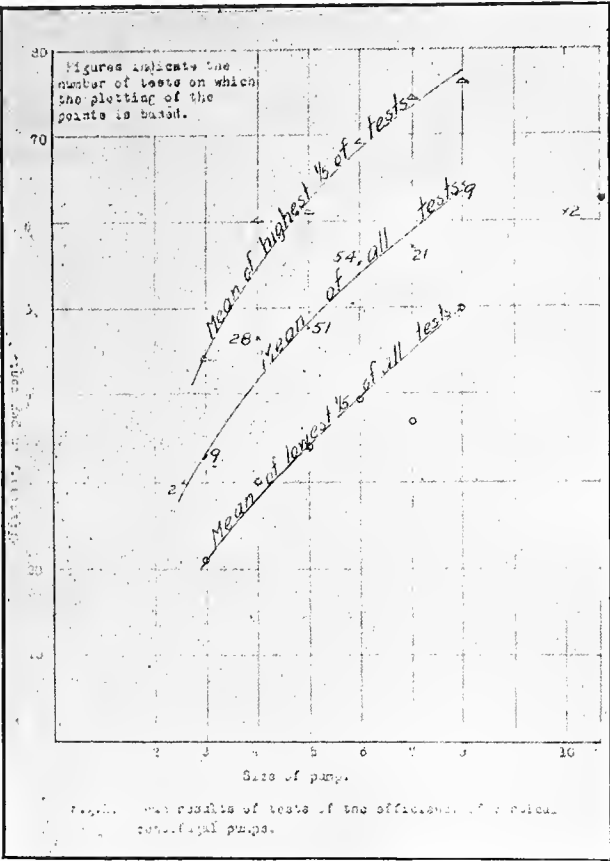
It is claimed by the companies' officers that the developments in Mono County are made imperative by

ANALYSIS OF VARIOUS TYPES OF IRRIGATION PUMPS.

BY R. H. CATES.

Vertical Centrifugal Pumps.

The largest number of tests were made on the vertical centrifugal type of plant and the means for this type are the most dependable. Curves showing the efficiencies for different sizes are plotted in Fig. 1. The numbers are the number of tests forming the mean result for each point. The points for the different sizes do not fall on a smooth curve. This is to be expected as other factors besides size affect the efficiency. The curves do show, however, the general increase in efficiency with the size. This is in accord-



ance with recognized usual practice. It is due to the smaller proportion of the mechanical losses in the larger sizes. It is also probably partially due to the greater care used in the construction and operation of the larger and more expensive plants.

Owing to the larger number of tests on vertical centrifugal pumps, an effort has been made to segregate the effects of various factors. This has only been done for the 4, 5, 6 and 7 inch sizes. The number of tests on other sizes were not sufficient for such classification.

Such a segregation was made on the basis of the height of lift for single stage pumps. The results are given in Table 3. The four segregations of lift were made for each of the four sizes of pumps. The results—the means were compared with the mean for the size of pump and the excess or deficiency computed. Table 3 gives the resulting excess or deficiency for all sizes combined. A somewhat lower efficiency at the lower lifts is indicated. For the smaller sizes multiple stage pumps are more usual for lifts of over 100 ft.

Table 3.
Variation of Efficiency of Single Stage 4, 5, 6 and 7-inch Centrifugal Pumps With the Lift.

Height of Lift.	Number of Tests.	Average Variation of Efficiency from Mean Efficiency.
Less than 50 feet.....	31	— 4.9
50 to 75 feet.....	49	— 0.3
75 to 100 feet.....	24	+ 4.7
Over 100 feet.....	24	+ 4.7

A classification was also made to see if the efficiencies for the different sizes varied with the amount of the vacuum or with the quantity discharged. The results were not conclusive. For vacuums of over 25 inches of mercury or 28 ft. of water, the average efficiencies were somewhat below the normal. Nearly one-half the plants operated at a vacuum of over 20 ft. With high vacuums efficient results can be obtained if there are no air leaks. Such vacuums, however, always involve the possibility of a material loss in efficiency if any leaks should occur.

The results of the classification of efficiencies on the basis of the discharge were also irregular and not conclusive except where the quantity pumped was materially less than the average.

Twenty-four tests of 2-stage pumps are available. These are used in some cases for lifts of from 75 to 100 ft. but more largely for lifts of over 100 ft. The results are given in Table 4.

Table 4.
Results of Tests of Two Stage Vertical Centrifugal Pumps.

Size of Pump.	Number of Tests.	Mean Discharge Miners' Inches.	Mean Lift. Feet.	Mean Pump Efficiency.
3	4	16	106	34.0
4	7	44	109	41.0
5	10	63	111	44.6
6	2	117	104	68.0
7	1	100	120	47.6

The results of a number of individual tests of vertical centrifugal pumps are given in Table 2. These cases were selected to bring out the extent to which various unfavorable factors may affect the efficiency. Such factors are usually faults in operation and not the fault of the pump itself. Operation at capacities, lifts or speeds different from those for which the pump was designed, air leaks in the suction, and worn or clogged runners, are some of the conditions found to reduce the efficiency by from one-third to one-half in some cases.

Horizontal Centrifugal Pumps.

The thirty tests on these types of installations include the sizes in general use, but those for any one size are not sufficient in number to give as dependable means as for the vertical centrifugal pumps. Comparing the results with similar sizes of vertical centrifugal pumps, the horizontal pumps have an average pump efficiency slightly higher than the vertical pumps. The average overall efficiencies are also somewhat higher due to the greater proportion of the horizontal pumps which are direct connected. These differences may, however, be within the probable error of the mean for the thirty tests available.

Horizontal centrifugal pumps are not generally used for pumping from wells in this territory, due to the larger pit which would be required, and the wide variation in pumping levels throughout the season.

Those tested are used mainly for lifting from canals or from reservoirs after the water has been

pumped from wells, or what is known as booster service.

The tests indicate an increase of efficiency with an increase of size, although the individual sizes vary.

Well Turbine Pumps.

The results of fifty-five tests of well turbine pumps are given. These are classified by sizes, the sizes given representing the size of the well casing in which the pump can be installed.

These pumps have multiple stages, the number of stages varying from 2 to 12, depending upon the lift and the discharge. The lift per stage varies from 12 to 40 ft.

The efficiencies increase in a general way with the size, although not as regularly as for the centrifugal pumps. This irregularity is probably due to the smaller number of tests for some of the sizes.

Comparison between well turbine and centrifugal pumps can best be made on the basis of equal discharge as the basis of the rating for size is different. The 12-inch turbines having an average discharge for 25 tests of 63 inches, gave a mean pump efficiency of 49.7 per cent. Fifty-one number 5 vertical centrifugal plants which had a mean discharge of 64 inches gave a mean efficiency of 47.8 per cent. Nine 24-inch turbines discharged an average of 115 inches with a mean pump efficiency of 55.6 per cent. Interpolating between the mean discharges and efficiency of the number 6 and 7 vertical centrifugal pump, the efficiency for a discharge of 115 inches would be about 55.4 per cent. A similar interpolation for a discharge of 84 inches gives a mean efficiency of 50.1 per cent for 8 turbine tests and 52.2 per cent for the vertical centrifugal pumps. These figures for the efficiency of the two types of plants are so nearly in agreement that there appears to be no material advantage in efficiency for either type.

The results of certain individual tests of well turbines the given in Table 2. These show the effect of various factors on the efficiency as explained in the remarks.

Propeller Pumps.

The basis of classification of propeller pumps is not as uniform as with other types. The twenty-one tests available are averaged without segregation in Table 1. The larger number of these were equivalent to an 8-inch size. The lift per stage is smaller with the propeller type of pump than with well turbines, being generally about five feet.

Further detail regarding the tests of this type of pump is given in Table 5.

Table 5.

Results of Tests of the Efficiency of Propeller Pumps.

Mean Discharge in Miners' Inches.	Number of Tests.	Pump Efficiency.	Mean Lift.	Number of Tests.	Pump Efficiency.
27	2	27.2	32	6	42.2
68	5	38.8	54	4	41.0
104	8	50.0	68	6	42.9
140	4	42.2	94	5	47.0
325	2	46.3	...	..	...

These figures are lower than those for vertical centrifugal and well turbine pumps of similar capacity, the difference in efficiency varying from 5 to 15 per cent. The number of tests of the propeller pump is relatively small and the results may not be altogether representative.

Piston Pumps.

The piston types of pump in use in irrigation can be divided into three classes, the deep well plunger pumps and the duplex and triplex pumps. The deep well plunger pumps are usually double acting, but due to the placing of the cylinders at the bottom of relatively deep wells with the long rods necessary for their operation and the greater difficulty in attention, the efficiencies are lower than for the duplex and triplex pumps. These latter two types are more generally used for booster service such as pumping from a reservoir to higher levels rather than for pumping from wells.

The tests of the piston pumps gave the highest efficiency of any of the types of pumps shown in Table 1. The deep well plunger pumps are considerably higher than centrifugal pumps of the same capacity. The same is true for the duplex and triplex pumps. Piston pumps are used on relatively high lifts so that such higher efficiencies result in relatively larger saving of power.

In Table 2, the results of some individual tests are given. Higher efficiencies were secured in two of these cases from higher lifts. The effect of gas in the water in reducing the efficiency is quite marked in the last case given. A similar loss of efficiency would occur with other types of pumps.

Air Lifts.

Only seven tests of air lift plants are available. The average efficiency was lower than that for the other types of pumps. The minimum result was obtained for a plant pumping less than 3 miners' inches, which is much smaller than usual irrigation practice. While the number of tests is small, the mean probably is fairly representative of average good practice with this form of lift.

In table 2 the results at a plant where an air lift was replaced with a well turbine are given. The turbine developed more water from the well and also at a higher efficiency.

Summary.

The general results are given in Table 1. A discussion of the efficiency of each type of pump with some comparisons with other types has also been given. Where the results with different plants of different sizes and types vary so widely, average results of all types or sizes furnish little indication of what can be expected in any particular case.

As a measure of the average conditions in the territory covered by the Southern California Edison Company, the average results of these 305 tests may be of value. The conditions vary within the different parts of the area, the lifts and the quantity of water secured from wells differing widely.

For the 305 tests, the average lift was 92 ft., and the average discharge 92 miners' inches. For all types of pumps the average efficiency of the pump was 51 per cent, and the overall efficiency for the plants 42.4 per cent. The ratio of overall to pump efficiency was 83.0. For these conditions an average of 2.51 miners' inches were pumped 100 ft. per kilowatt of input. This is equivalent to 2.42 kilowatt hours per acre foot lifted one foot. It will be remembered of course, that it is not advisable to base estimates for individual installations upon average figures.

THE INSTALLATION OF ELECTRIC HEATING APPARATUS.

BY. E. A. WILCOX.

Correct Installation.—This is essential for ranges, water heaters, and other heating devices. If wires are too small, the service will be poor. If the appearance of the work is not good, the user will be dissatisfied. If proper protection against electric shocks is not afforded, the customer may be in constant fear. If a range, for instance, is not placed in such a position that it can be conveniently operated by the cook or housewife, she may form mental prejudices that will be difficult to overcome. Intelligent supervision and careful inspection of all heating installations will be of mutual benefit to all concerned.

Wiring for Heating Apparatus.—The Code of the National Board of Fire Underwriters should be adhered to as closely as possible in wiring for heating apparatus. Furthermore, local city and state rulings have a distinct legal status the importance of which should not be overlooked. Unfortunately the National Code rulings which apply to the installation of heating service are in some cases burdensome, and in others not strict enough.

All wiring should be done in a neat and workmanlike manner so that an electric installation will not detract in any way from the appearance of the premises. Electric ranges, water heaters, and other heating devices on the market usually look attractive, but if they are not properly connected and installed the general appearance may be bad.

Carrying Capacities of Wires.—The allowable carrying capacity of conductors operating under pressures of 120 volts, two-wire, and 120-240 volts, three-wire, are given in Table I for convenient reference

Size B. & S. Gauge.	Area Circ. Mils.	—Rubber Covered—		—Weather Proof—	
		120 volt. 2-wire.	120-240 v. 3-wire.	120 volt. 2-wire.	120-240 v. 3-wire.
0000	211,600	27,000	54,000	39,000	78,000
000	167,800	21,000	42,000	33,000	66,000
00	133,100	18,000	36,000	27,000	54,000
0	105,500	15,000	30,000	24,000	48,000
1	83,690	12,000	24,000	18,000	36,000
2	66,370	10,800	21,600	15,000	30,000
4	41,740	8,400	16,800	10,800	21,600
6	26,250	6,000	12,000	8,400	16,800
8	16,500	4,200	8,400	6,000	12,000
10	10,380	3,000	6,000	3,600	7,200
12	6,530	2,400	4,800	3,000	6,000

Wires of sufficient size to conform to the allowable carrying capacities in the above table will conform to the Underwriters' Code but may prove too small to insure good service. This will be true if the run is a long one because in the above table no account is taken of its length.

Table II shows the drop in voltage (below 120) that may be figured per hundred feet of both two and three-wire circuits. The calculations are based on an assumed pressure of 120 volts for two-wire service and 120-240 volts impressed on a three-wire circuit.

No. B. & S. Gauge.	2500		5000		7500	
	2- wire.	3- wire.	2- wire.	3- wire.	2- wire.	3- wire.
0000	.204	.102	.409	.204	.619	.306
000	.258	.129	.515	.258	.774	.386
00	.325	.162	.650	.325	.975	.487
0	.410	.205	.819	.410	1.229	.615
1	.517	.258	1.033	.517	1.550	.775
2	.651	.326	1.303	.651	1.954	.977
4	1.036	.518	2.071	1.036	3.107	1.553
6	1.647	.824	3.294	1.647	4.941	2.471
8	2.618	1.309	5.237	2.618	7.855	3.927
10	4.164	2.082	8.329	4.164	....	6.246
12	6.623	3.312	....	6.623	....	9.935

No. B. & S. Gauge.	10,000		15,000		25,000	
	2- wire.	3- wire.	2- wire.	3- wire.	2- wire.	3- wire.
0000	.818	.409	1.238	.619	2.044	1.022
000	1.030	.515	1.548	.774	2.576	1.288
00	1.200	.650	1.950	.975	3.250	1.625
0	1.638	.819	2.458	1.229	4.096	2.048
1	2.066	1.033	3.100	1.550	5.166	2.582
2	2.606	1.303	3.908	1.954	6.515	3.257
4	4.143	2.071	6.214	3.107	....	5.178
6	6.588	3.294	9.882	4.941	....	8.235
8	....	5.237	....	7.855	....	....
10	....	8.329	....	....	....	....
12	....	....	....	....	....	....

Correct Voltage.—For heating apparatus this is important. Many complaints may be obviated by supplying energy at a pressure as near as possible to the rated voltage of the apparatus. Low voltage results in slowness of operation, and excessively high voltage is likely to cause burn outs.

Assume a heating element rated at 1100 watts and 110 volts is supplied with energy at a pressure of 100 volts. The resistance of the element is therefore: $R = E/I = 110/10 = 11$ ohms.

At 100 volts pressure the quantity of current flowing would be $I = E/R = 110/11 = 9.1$ amperes and the wattage dissipated in heat would be $W = EI = 9.1 \times 100 = 910$ watts. The efficiency of operation of the element, therefore, would be $910/1100 = 82.7$ per cent, whereas the voltage was supplied at only $100/110 = 91$ per cent of the normal rating.

Voltage readings should always be made at the terminals of the heating device at no load and at full load, otherwise the drop in voltage in the service leads or interior wiring may be overlooked, and a wrong impression gained.

Methods of Wiring.—How to wire a building for heating service should be carefully considered before the actual work is undertaken. Exposed wiring with knobs and cleats is safe and cheap but is seldom used because of its unsightliness. Moulding work is sometimes installed in old buildings but unless the work is done extremely well it may look unattractive. The concealed knob and tube method is often used in both new and old buildings and the work may usually be done at reasonable cost. Rigid or flexible conduit, or steel armored conductor wiring are generally considered to be the best, although the most expensive methods.

Exposed Knob and Cleat Wiring.—This is often used in wiring for heating and cooking service and in places where appearance is of little consequence it is one of the cheapest and best. The wires may be single braid rubber-covered or slow burning weather-proof. In cellars or other places exposed to moisture rubber-covered wire must be used.

Wooden Moulding Wiring.—Where a neat appearing low-priced job is required this construction may well be used. Its use in damp places is however prohibited by the Underwriters. Single braid rubber-covered wire is required. For first class work hard wood moulding, matching in finish the trim of the room, can be used.

Wiring in Metal Moulding.—As this is restricted to circuits carrying not more than 1320 watts it is seldom employed for heating or cooking circuits. Single braid rubber-covered wire may be used for this class of work. Metal moulding must always be grounded permanently.

Concealed Knob and Tube Wiring.—In frame buildings where a low cost of installation is essential the wires may be installed within floors and partitions. Wires can ordinarily be concealed in this manner more cheaply than by any other method. Single braid rubber-covered wire may be used.

Rigid Iron Conduit.—This is approved for both exposed and concealed work. Ordinarily it is probably the best, although the most expensive. Double braid, rubber-covered wire must be used in rigid conduit. The same conduit may contain as many as 4 two-wire or 3 three-wire circuits. Stranded wire in sizes larger than No. 6 is customarily used for rigid conduit work. Rigid conduit must be permanently grounded.

Table III.

Size of Wire, B. & S. Gauge.	Size of Conduit, Inches.					
	Two Wires in Conduit.			Three Wires in Conduit.		
	Short Run.	Medium Run.	Long Run.	Short Run.	Medium Run.	Long Run.
10	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1
8	$\frac{3}{4}$	$\frac{3}{4}$	1	1	$1\frac{1}{4}$	$1\frac{1}{4}$
6	1	1	$1\frac{1}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{4}$
4	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$
2	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	2
1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	2	2
0	$1\frac{1}{2}$	2	2	2	2	2
00	$1\frac{1}{2}$	2	2	2	2	$2\frac{1}{2}$
000	2	2	2	2	$2\frac{1}{2}$	$2\frac{1}{2}$
0000	2	2	$2\frac{1}{2}$	2	$2\frac{1}{2}$	3

Table III shows the size of double braid rubber-covered wires that can readily be pulled into conduit.

Flexible Metallic Conduit.—For all kinds of exposed or concealed work such construction is often preferable to rigid conduit. The installation of flexible conduit can be made easier, quicker, and more cheaply than can rigid conduit. The same code rules apply to flexible as to rigid conduit. It must be securely grounded. Double braid rubber covered wire is required. Flexible metallic conduit may be used to advantage in finished houses and in frame buildings.

The sizes of wire that may be accommodated in flexible steel conduits are given in table IV.

Table IV.

Nominal Inside Diam. In Inches.	Largest Wires Accommodated.		
	One Wire.	Two Wires.	Three Wires.
$\frac{1}{2}$	8	12	12
$\frac{3}{4}$	2	10	8
1	00	0	0
$1\frac{1}{4}$	200,000	4	6
$1\frac{1}{2}$	400,000	1	1
2	800,000	200,000	00

Flexible Steel Armored Conductor.—Here a cable consisting of rubber-covered wires is protected from injury and to a certain extent from dampness by two layers of flexible steel armor. It may be obtained leaded or unleaded. The leaded cable differs from the unleaded in that it has a lead covering between the wire and the steel armor to protect it from excessive dampness. Both the leaded and the unleaded cables are made with single and multiple conductors of almost any gauge wire. The leaded cable is approved for all classes of work, open or concealed, in fireproof or non-fireproof buildings, and in new or old houses. The unleaded cable is approved and may be used for open or concealed work in places not subject to moisture.

For wiring old buildings steel armored conductor can be used to great advantage. It can be run with utter disregard to contact with pipes or other materials and may be fished for long distances. It can be installed quicker and with less cutting away of the walls and floors than either rigid conduit, flex-

ible tubing, or concealed knob and tube work. Steel armored conductor should always be carefully grounded.

The Main Entrance Switch.—For three-wire heating circuits this should always be of the fused type with the neutral fuse coppered.

Control Switch.—Heating devices should be provided with control switches that will indicate at a glance whether the circuit is open or closed. The switch should be mounted on the device or on the wall immediately adjacent to it so as to be easily accessible. It should be of the enclosed knife blade or snap switch type and so designed as to entirely disconnect the heating appliance at the wish of the operator.

Grounding.—The frames of all heating appliances, especially those of the larger types, should be carefully grounded, whether they are connected to two-wire or three-wire circuits. Satisfactory grounding may be accomplished by connecting the frame of the device to a water pipe. If the appliance is operated from a three-wire grounded neutral system the frame may be connected to the neutral wire. In case of doubt as to the character of the ground on such a system, the neutral may be grounded, in turn, to some convenient water pipe inside the building.

When a rigid or flexible metallic conduit or steel armored conductor job is installed, the frame of the device may be grounded to the conduit or steel armor; provided, of course, the conduit or armor is itself grounded elsewhere.

Ranges in Apartment Houses and Flats.—In this case separate circuits from the main switchboard are necessary. Each circuit must be fused but in the case of three-wire circuits the neutral should be coppered.

Main service wires and switches supplying group cooking loads are never called upon to carry the entire connected load. Apartment houses equipped with ten or more ranges are never known to have a demand greater than one-fourth the connected load. The larger the number of ranges supplied from a single service the less will be the demand in proportion to the load connected. This is a condition seldom met with in supplying other classes of electric service and one for which no provision has been made in the Underwriters' Code. It is obvious, however, that to install service leads, main switches, fuses, etc., of sufficient carrying capacity to handle the total connected load would be of no advantage, and would involve needless expense.

The Proper Position for a Range.—The range should be located where it can be operated with ease and convenience. If it is placed where the light is bad, in an inaccessible corner of the kitchen, or where the cook or housewife has to walk back and forth a greater distance than that to which she has been accustomed, a serious prejudice may be created in her mind. An electric range is often installed in a kitchen by the side of a coal, gas, wood, or oil range, the latter being left in, either for auxiliary use or for want of a better place for storing the old equipment. When this condition is met, every endeavor should be made to secure permission to place the electric range in the most advantageous position. Otherwise the customer will have a tendency to use the appliance most favorably located for most of her work.

THE POLICY OF UTILITY.

In a discussion of efficiency methods in public utilities at the recent convention of the Pacific Coast Gas Association, Mr. E. L. Hall of the Portland Gas & Coke Company outlined some very useful pointers that must be borne in mind in order that efficiency may flourish in a public utility, an excerpt of which appears in the following lines:

The ideal aims of the utility, rightfully considered and firmly established, form, as it were, the soul of the utility, while efficiency methods are the brains and the organization the hands. Even as the man with a paltry soul, a narrow mind, and sordid instincts, may not succeed greatly, so will it hardly be feasible for a utility organized under similar lines to attain that ultimate standing in the community which will insure a sound business and reliable profits.

Efficiency methods and clock work organization may, therefore, only achieve permanent success when inspired by high motives and right principles, and those utilities throughout the land whose position is being daily strengthened, are those wherein such principles have been whole-heartedly observed and permeate their organization.

Failure or success of efficiency methods depends in a great measure upon the general policy of the company. It may be conceived that the aim of any utility is essentially to make reasonable earnings for the stockholders. Modern conceptions have insisted that such returns will derive their permanence and security chiefly through the good will of the community served and freedom from embarrassing legislation.

Such good will is secured principally by the quality of service rendered, by a public spirited attitude towards municipal progress, by a liberal and humanitarian treatment of employes, and above all, by a generally sympathetic and progressive attitude.

Freedom from oppressive and embarrassing legislation is a logical sequence of public good will.

As applied to the inner workings of the utility, the foregoing finds application principally in the inculcation of progressive ideas throughout the rank and file of the stockholders, officers, and employes, so that concerted efforts are made possible toward the realization of the aims and purposes of the utility. An understanding of the psychology governing the attitude of employes towards the utility, towards the public and towards one another is an essential for the establishment of the right esprit de corps. The creation of such a favorable atmosphere is thus the first requisite and step toward the inauguration of efficiency methods. The essential thought which must permeate the organization is that results cannot be accomplished by individual effort as cheaply and expeditiously as by concerted action. In a word, team work must replace the natural desire of the individual for direct action. At all cost, the ego must be suppressed. Pride in organization should replace pride in one's self.

At the same time, since the assertion of individuality is a means by which each employe earns his promotion and establishes himself, and since this individuality is, from an organization standpoint, to be

subjected to team work, the reward attendant to the success of concerted efforts should flow with certainty to each and every individual employe responsible for such success. In other words, if the employe is to efface himself he must well understand that he will not lose thereby. A lack of appreciation of this psychology creates suspicion and antagonism towards the efforts of the leaders in efficiency work. Too often those intrusted with working up an efficiency organization are powerless to remove the muzzle from the ox when he treadeth out the corn.

Failure to establish a generally receptive attitude towards efficiency methods quite frequently results from neglect of the management to furnish the necessary incentive.

To recapitulate: The following policies are necessary for efficiency to flourish:

1. A liberal conception of the duties and aims of the utility.
2. A progressive environment and personnel.
3. Provision for sufficient incentive.

COST OF ELECTRIC COOKING.

A recent advertisement of the Minneapolis General Electric Company contains some statistics showing the actual cost of electricity in households of various sizes where cooking is done electrically. The figures are quoted:

Number in Family.	Average Monthly Bill.
Family of three	\$2.62
Family of four	2.79
Family of five	2.82
Family of six	3.05
Family of seven.....	4.46
Family of eight	5.99

It will be remembered that the Minneapolis company in the spring of 1916 reduced its rates so that in the tertiary step all domestic customers secure electricity at a cost of 2½c (less 5 per cent prompt payment discount) per kilowatt hour. As a result of this rate the amount of electric cooking business secured in Minneapolis during the summer and fall has been gratifying.

INDUSTRIAL FATIGUE.

A scientific investigation upon industrial fatigue by a well known English authority as set forth in the Electrical Review published in that country, is timely and interesting:

The author draws from his observations a strong argument against the practice sometimes adopted of working on Sunday; whereas in normal times the lessened efficiency found towards the end of the week is remedied by the rest obtained on Saturday afternoon and Sunday, if Sunday labor is introduced the rest period is inadequate, and the fatigue becomes permanent and cumulative, so that eventually the worker either breaks down under the strain, or, consciously or otherwise, slackens his efforts until equilibrium between fatigue and recuperation is once more attained. In either case the result is disastrous from the point of view of output, and often from the point of view of health also.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Twenty-two dollars a year is spent on an average by every person in the United States for electrical material and service. Four dollars of this goes to the central station.

* * *

The Court Square of Memphis, Tenn., rich in traditions of the days of Andrew Jackson, is to have its beautiful fountain elaborately lighted during America's Electrical Week.

* * *

Enough hydroelectric energy is running to waste to equal the daily labor of 1,800,000,000 men or 30 times our adult population, according to Secretary of Interior Franklin K. Lane.

* * *

A concerted movement on the part of manufacturers, engineers, and college authorities is now under way that bids well to bring research and business into closer contact in the future.

* * *

Seventy per cent of the people of this country use electricity in some form every day of their lives. Five per cent of the people—five million persons—derive their living directly or indirectly from the electrical industry.

* * *

The new year is soon to be here. Herbert Kaufman's advice is apropos of this season of resolutions: "You've tried one pass key to opportunity and it didn't fit—but what of that? Keep trying them, and unexpected doors may open to you."

* * *

One of the heaviest cables ever handled by a power, telephone or telegraph company was recently installed in Vineyard Sound in Massachusetts. It is a twelve conductor telephone cable and is 2.69 inches in diameter, weighing 10.6 pounds to the foot.

* * *

In comparison with over fifty million horsepower of locomotives, over forty million horsepower of automobiles and a total of over one hundred fifty million mechanical horsepower, government reports show that thirty million horses and mules are in service today in the United States.

* * *

An Eastern power company boasts one electric range per one thousand population. To beat Western enterprise the wise men of the East will have to do better than this, since a power company in Southern California has itself actually sold already over twelve hundred electric ranges.

* * *

A huge revolving ball of light crowning the top-most pinnacle of the highest building in Toledo, Ohio, rising five hundred feet from the street level, will soon be seen miles in every direction around this enterprising city. This ball of light will measure twelve feet in diameter and will be equivalent to about five thousand ordinary electric sign lamps.

Here are six reasons for wiring old houses, according to the Louisville Gas & Electric Company: (1) Money invested in house wiring pays 25 per cent; (2) Wired houses sell for more; homeseekers want modern conveniences; (3) Electric wiring is "tenant insurance"; (4) Electric service is economical; (5) Electric light is convenient; (6) Electric light lessens fire hazard.

* * *

In the presence of President Wilson and a distinguished gathering of foreign ambassadors and representatives America's Electrical Week will be fittingly ushered in on December 2d by the inauguration of the permanent flood lighting of the Statue of Liberty. More reflectors will be required to accomplish this feat than have been required to flood-light any building or palace to date.

* * *

Ohio has gone a step farther than bringing municipal plants under the same regulation as private plants and requires that municipal plants either must sink or swim on their own resources and cannot draw on the general tax fund to pay deficits. This is good business and for the protection of the public. There seems to be no valid reason why these plants should not come under the public service commission rulings.

* * *

The continued increase in the market price of coal and crude petroleum is beginning to affect earnings of central stations the country over. The New York Edison Company stipulates that it may have to reconsider its acceptance of a reduced rate arrangement because of the grave uncertainties with which the future of operating costs is clouded, and in so doing it calls attention in a necessary way to an uncontrollable element which the future holds.

* * *

Railroad electrification seems to have brought out unthought of advantages over steam propulsion. Last winter, for instance, the Mogul engines on the St. Paul, with the temperature at 40 below zero, froze to the tracks, with more than half a mile of cars behind them. The electric motor, with only two engineers aboard, as against six to pull and push each of the freight trains, pulled the locomotives and trains to their proper destination, working even better in cold weather than such motors do when the weather is warmer.

* * *

The electrical man, if there be one, who does not believe in co-operation may well ruminate over the words of Emerson: "There is a time in every man's education when he arrives at the conviction that envy is ignorance, that imitation is suicide; that he must take himself for better or for worse as his portion; that though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given him to till.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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Experience in business-getting is each day proving itself to be of vital necessity to the engineer. Some years back, when gigantic progress was being made in the evolution of electrical engineering, fame and fortune were often amassed by a man who had ability in pure and applied engineering science alone without particular training in the art of business-getting.

In those days the idea of electrical novelty and the vastness of an unexplored field made possible such a state of affairs. Today, however, conditions have changed. Much of the former unexplored realm of electrical application has now been traversed, mapped and put to commercial use.

In view of this fact there is a tendency for the modern, young engineer to be swamped or muddled in the application of this complex accumulated data. Actual experience in business-getting is the only way in which one may learn to unravel the tangled mass and put it to a useful purpose.

As stated in a recent address by a noted business expert in electrical affairs, the man in the selling game has to think, think straight and think quickly. There is no better experience than to have a try at the actual selling of goods. If the engineer has at one period in his career made a marked success as a salesman, there is hardly a job that he can tackle in after years which he can not finish successfully due to this valuable experience gained in the field of salesmanship.

Again, looking at the proposition from the other viewpoint, the art of business-getting is vastly advanced by having in its ranks men of the trained analytical mind. The great electrical industrial companies have in recent months come to this forceful conclusion. So much so, that the applications of cadet engineers or apprentices are largely today approved on the basis of the future business-getting possibilities that the young embryo engineer seems to possess.

Engineering as a profession is rapidly broadening in its scope of usefulness. The business-getting, managerial and executive departments of large corporations are looking to the ranks of the young engineers for their future heads and directors.

A thorough business training and experience is hence to be sought by the engineer, and with this brought to realization, success is sure to await the future.

During recent years—especially since the beginning of the present international war—the campaign for

Power Development vs. Natural Beauty

"See America First" has received the commendation and moral support of all well-wishers of the West. It is true beyond the question of a doubt that sentiment is not alone the leading factor that urge men to ask their fellow citizens to become more intimately acquainted with the natural beauty of their own country before spending time and money abroad. Beneath it all there is a deep conviction on the part of those who have seen the really great

and sublime works of nature in this country and compared them with the choicest collection of natural wonders to be found elsewhere in the world that here God seems to have blest man with natural beauty wonders to a greater degree than to be found elsewhere. A glimpse of Niagara, the Yellowstone, the Yosemite, the Hetch Hetchy, the Grand Canyon, the Glacier National Park and a hundred other of our fairy wonders is abundantly convincing to every doubting Thomas.

Hence it is not surprising that a storm of protest is heard on all sides when it is thought that some natural beauty is to be destroyed by the hand of man in search of water power development. And it is perfectly right and proper that this storm of protest should be so all-sweeping as to prevent the proposed work in instances where undue trespass is being made upon our storehouse of natural beauty.

Upon careful investigation, however, practically all of the protests against proposed water conservation or power development on the grounds of wanton destruction that have been registered in recent years have proved unwarranted after all the facts have become known.

A special instance of this has proven true in the case of the Hetch Hetchy. Here is an instance where in more publicity was given in magazines of national repute than in any other case. And yet today the visitor to this beautiful valley must admit that the accessibility brought about by the splendid road that has been built there by the authorities of the city of San Francisco has far repaid the imagined sacrifice of natural beauty. Indeed, it must be admitted that the completion of this highway around the proposed lake and the increased beauty resulting from the creation of this lake will make the wonderful waterfalls and massive vertical cliffs of this impressive gorge even more imposing.

On another page of this issue is to be found a discussion of the Rush Creek controversy that involves certain development work of the Pacific Power Corporation. The perusal of its contents will give the readers of the Journal a fairly good idea of the many points or arguments that are thrown in the way of the power company desirous of developing the natural resources of a sparsely settled country.

The "scenic protest" is like the New York "Mother Hubbard" that is said to cover everything and touch nothing. True lovers of the scenic beauty of the West should see to it that natural beauty is not wantonly destroyed and yet at the same time that equi-balanced justice is given to the company earnestly engaged in promoting the welfare of a new country by developing its natural resources to their highest stage of productivity.

It is true that hydroelectric development in the West is at present receiving an impetus due to the

The Scarcity of Oil Scare

high market price of fuel oil. It is likewise true that the Director of the U. S. Bureau of Mines in a recent address predicted the exhaustion of the crude petroleum supply some thirty years hence at the present rate of consumption.

The most casual investigation, however, will show that the present high price of crude oil is not due to any apparent diminution in the production of this product, for during September of the current year two hundred and sixty thousand barrels were produced as opposed to the two hundred and fifty thousand of January, 1915.

Again, according to Secretary Lane in Senate Document 310, it is shown that the percentage of exhaustion in all oil wells is but twenty-six and the estimate of oil still in the ground of the known fields in California is 2345 million barrels. At the present rate of production this should last for three hundred years.

As to the argument that the oil supply should be set aside for the enlarged navy, it may be mentioned that Secretary Daniels estimates the oil consumption for this purpose, when counting the addition of nine battleships and seventeen destroyers will be seven hundred and sixty barrels, which in times of war may be placed at five million barrels annually.

The government already has undisputed title to Naval Reserve No. 1 in California, which at this same hearing was shown by officials of the United States Geological Survey to hold in reserve one hundred million barrels, a supply adequate for fifty years for the national navy.

By examining the factors that enter into fuel oil consumption, it will also be seen that a decreased use may be expected from many quarters. The success of the electrification of the Rocky Mountain Division of the Chicago, Milwaukee & Puget Sound, followed by the recent announcement of the early electrification of the Great Northern Railroad but presages the similar electrification of all Western trunk lines in the immediate future. Such procedure will vastly lessen the demand for fuel oil.

On the other hand the continued announcement of oil discoveries in various sections of the United States and more recently of Alaska give promise of an ever widening field of development of this product rather than a diminution in supply.

The time was not far back when steam auxiliary plants of the West were built oil fired, but with spacious apartments left for coal bunkers in case of the necessity of a change over from fuel oil to coal operation. No such uncertainty today exists.

The present abnormal market value of this product is, however, making many central station managers seriously ponder the possibility of hydroelectric development which again will lessen the consumption of oil.

As soon as the unusual conditions brought on by the present international war readjust themselves the gigantic demand now being made upon the oil fields will again be lessened and the market value of this product will undoubtedly drop to a more reasonable figure.

Hence, from every reasonable point of view it is to be seen that the present "scarcity of oil scare" is but a temporary aberration and those having to do with either the production or the consumption of this valuable product may look forward to an early balance in demand and continued supply.

PERSONALS

O. B. Stubbs, owner of the Stubbs Electric Company of Portland, is at San Francisco.

H. A. Joslin has been appointed local manager of the Oregon Power Company at Eugene, Ore.

Charles French, electrical contractor of Vallejo, spent a few days in San Francisco last week on business.

L. F. Youdall, manager of the Electric Machinery & Equipment Company of Stockton, was a recent business visitor at San Francisco.

Frank Cook, sales representative of the Ohio Brass Company, Mansfield, Ohio, is making an extended tour throughout the Northwest.

E. A. Quinn, general superintendent of the San Joaquin Light & Power Company of Fresno, was a recent visitor at San Francisco.

C. D. Lamoree, salesman for the Westinghouse Electric & Manufacturing Company of Los Angeles, was a recent visitor at San Francisco.

W. C. Johnson, of the Westinghouse Electric & Manufacturing Company's San Francisco office, spent a few days at Terre Bella last week.

W. E. Camp, with the General Electric Company at Sacramento, was at San Francisco this week in regard to America's Electrical Week.

H. L. Jackman, manager of the Western States Gas & Electric Company, of Eureka, Cal., was a recent business visitor at San Francisco.

R. L. Eltringham, electrical engineer of the Industrial Accident Commission of California, is inspecting power systems in Southern California.

H. A. Barre, electrical and mechanical engineer for the Pacific Light & Power Company of Los Angeles, spent a few days this week at San Francisco.

J. H. McCarthy, formerly with the Electric Railway & Manufacturers' Supply Company, has recently returned to that company after spending a few months farming.

A. J. Myers, Pacific Coast manager of the Wagner Electric Company, will return to San Francisco about the first of the month, after an extended trip in Southern California.

J. S. Thompson, president of the Pacific Electric Manufacturing Company, has recently left San Francisco for a six weeks' trip to New York and other Eastern cities on business.

Eugenia Galvin, formerly electric range demonstrator for the Pacific Gas & Electric Company, has recently joined the sales force of the Western Auto Electric Company at Fresno, California.

B. J. Klein, Pacific district manager of the Bristol Company of Waterbury, Conn., gave an interesting talk at a meeting of the San Francisco purchasing agents' club last week on recording instruments.

F. H. Leggett, who has been Pacific Coast manager of the Western Electric Company during the past three years, will return to the company's executive offices in New York City after the first of the year.

F. D. Fagan, Pacific Coast manager of the Edison Lamp Department of the General Electric Company, will return to San Francisco about the first of the month, after four weeks' business trip throughout the Northwest.

Leoto Sol, with the department of agriculture of the Argentine Republic, is a recent visitor at San Francisco. He is here to investigate the possibilities of the manufacturers of the western coast doing business with his country.

R. M. Alvord, manager of the appliance department of the General Electric Company at San Francisco, who was recently married, will return to San Francisco from a short

honeymoon about the first of the month, spent in Southern California.

N. P. Melnikoff, engineer attached to the cabinet of his Majesty, Emperor of Russia, and professor of the Electro-Technical Institute of the Emperor, Alexander the Third, of Petrograd, Russia, is a recent visitor at San Francisco. He is spending a few months in the United States studying the possible electrical affiliations of the two countries.

E. J. Wallis will succeed **F. H. Leggett** on January 1st as Pacific Coast manager of the Western Electric Company. He is expected to be at San Francisco soon after the first of December. Mr. Wallis has been succeeded as manager of the company's southern district at Atlanta, Ga., by **F. B. Gleason**, formerly Pacific Coast manager and recently manager of the Western Electric Company's business in the Far East.

W. P. L'Hommedieu, of the Westinghouse Electric & Manufacturing Company; **S. J. Lisberger**, of the Pacific Gas & Electric Company; **W. A. Hillebrand**, of the Pacific Gas & Electric Company; **E. A. Quinn**, of the San Joaquin Light & Power Company, and **H. A. Barre**, of the Pacific Light & Power Company, had a meeting of the standardization committee of the N. E. L. A. for the purpose of standardizing transformer sizes and voltages, at San Francisco last week.

MEETING NOTICES.

Los Angeles Jovian League.

With **John G. Monahan**, district manager of the Sangamo Electric Company, as chairman of the day, the November 15th meeting was well up to the high standard set in the past. Caharet entertainment was provided by the Andrews sisters, who told dialect stories and sang songs. **John L. Butler**, chief of police, spoke on "Police Problems and Their Solution."

Portland Meeting A. I. E. E.

The regular monthly meetings of the local sections of the American Institute of Electrical Engineers and National Electric Light Association, was held in the Auditorium of the Y. M. C. A., Portland, Oregon, Tuesday evening November 14th. Mr. **Walter Haynes** of the Y. M. C. A. Engineering School Faculty, presented a paper on "General Principles of Wireless Telegraphy and Telephony," with a demonstration of apparatus. Mr. **L. T. Merwin** was chairman of the meeting. After the meeting light refreshments were served. Seventy members were in attendance.

San Francisco Section A. I. E. E.

The section will meet at the Engineers' Club, November 24th, at which time three papers will be presented: 1. "A Study of Ceramics of Insulators," by Professor **Harris J. Ryan**; 2. "Progress Report On the Study by California Power Companies of Insulator Deterioration," by **J. C. Clark**; 3. "Investigation of Suspension Insulator Deterioration by California Power Companies," by **J. E. Woodhridge** and **J. P. Jollyman**. An excursion is being arranged to visit the laboratories at Stanford University, where the tests and experiments have been carried on in connection with the above, the plan being to leave San Francisco, Third and Townsend street station, at 1:20 p. m. Saturday, November 25th.

Electrical Development and Jovian League.

San Francisco's new aquarium was the subject of the league meeting on November 15th. With **R. E. Fisher** as the chairman of the day, with fish as the main part of the menu and with the presence of the president of the Fish and Game Commission, the piscatorial features of the meeting were well cared for. Mr. **Ignatz Steinhart**, who will donate sufficient to build an aquarium, briefly introduced the subject, saying that the aquarium would be erected as a memorial to his deceased brother and that funds for its maintenance had been provided by the people passing an amendment at the last election. He presented Dr. **B. W. Evermann** who is in charge of the Academy of Science Building in Golden Gate Park. Dr. **Evermann** stated that an aquarium is a wonderful asset

for a city. He told of the peculiar climatic advantage at San Francisco and illustrated his remarks with a beautiful collection of lantern slides showing aquaria throughout the world as well as typical fish that may be found in the San Francisco aquarium. M. H. de Young urged that the quarium be built in Golden Gate Park, but the League did not take a vote on the question. T. E. Collins, Congressman of the Jovian Order, explained the need for an increase in the national Jovian dues and urged all members to continue their membership.

Pacific Coast N. E. L. A. Section.

R. H. Ballard, secretary and assistant general manager of the Southern California Edison Company and vice-president of the National Electric Light Association, has filed an application for authority to form a geographic section of the National Electric Light Association, which will undoubtedly be acted upon at the December meeting of the executive committee. This will be known as the Pacific Coast Section, and will embrace the states of California, Arizona, Nevada and New Mexico. When official sanction has been given this application, steps will be taken toward perfecting organization details and getting formally under way.

The Pacific Coast Section is the result of a growing and insistent demand among members of the National Electric Light Association in the West during the past few years for an association which would provide the benefits of the National Association and which, also, would be better able to cope with the conditions and problems peculiar to this section of the country. It will, therefore, be the object of the section to carry out the aims and purposes of the National Association, and, furthermore, extend to its members special privileges and advantages which the parent organization is unable to offer. It will also strive to bring about a closer affiliation between its members and afford a better medium for the exchange of opinions, experiences and conclusions regarding the many complex problems arising in the central station industry, many of which are not only of local interest, but of importance to the industry as a whole. Especially is this true in the development of the electrical business in the West.

The section will include in its membership the engineering and scientific professions, electricians, manufacturers, publishers, bankers and others interested in promoting the use of electricity, as well as central stations and their employees. The meetings and sessions will be held at points convenient of access to members, thus enabling the attendance of a large number who heretofore have found it impossible to attend the conventions of the national body and every encouragement will be given to members to participate in its sessions.

Geographic sections have been formed in different parts of the country, and conditions in the West seem to offer possibilities for even greater results than obtain in any other section. Applications for affiliation in the new section have been received from an exceedingly gratifying majority of the N. E. L. A. members in the above states, evidencing the strong sentiment in favor of the plan.

NOTES OF CALIFORNIA WATER COMMISSION.

The Paradise Irrigation District of Paradise, Butte County, organized March, 1916, has applied for permission to appropriate 19,600 acre feet, equivalent to 66 second feet, by the storage of flood waters of Butte Creek, to be used in the irrigation of the lands of the district, in Butte County. The storage and diversion dams are one and the same. The proposed dam specifications are given in the application as follows: 134 ft. high, 1250 ft. long on top, 710 ft. long on bottom, 20 ft. wide on top, constructed of earth, hydraulic fill, rock rip-rapped on face, loose rock or asphaltic concrete on back, concrete cut-off wall, concrete waste-way in natural rock at side. The main ditch or pipe line is given as 7600 ft. It is proposed to begin work in the summer of 1917 and

complete in two years. The number of acres to be watered is 11,100, which are also involved in two other applications the district now has before the commission. The estimated cost of this diversion is given as \$350,000.

A. L. Richardson of Placerville has applied for permission to appropriate $1\frac{1}{2}$ cu. ft. per second of the waters of a creek flowing from Eagle Lake into Emerald Bay, tributary to Lake Tahoe, in Eldorado County. At a cost of \$1200, applicant proposes to develop enough water for a hotel service and to operate a small electric plant for the hotel.

H. O. Kohler and A. Schwartz of Washington, Nevada County, have applied for permission to appropriate waters of Scotchman's Creek, tributary to South Yuba River. The proposed main ditch is two miles long, and there is a dam 10 ft. high, 35 ft. on top and 25 ft. on bottom, the works to cost \$4725.

The Farm Land & Investment Company of San Francisco has applied for permission to appropriate 100 cu. ft. per second of the waters of the Yuba and Feather Rivers, tributary to the Sacramento River, in Yuba County, for the culture of rice. The proposed diversion is to be by means of one 24 in. and one 30 in. centrifugal pump electrically driven. The number of acres to be watered is 5500 and the estimated cost is \$31,000. The same company, in a second application asks permission to divert an additional 200 second feet from the Feather River and Plumas and Messick Lakes, also tributary to the Sacramento River. A 24 in., 36 in. and 40 in. electric pumps are to be used in this diversion, for 8500 acres at a cost of \$31,000.

The Twenty-One Mining Company of Phoenix, Arizona, has applied for permission to appropriate $1\frac{1}{4}$ cu. ft. per second of the waters of Gravel Tunnel, at the head of Buckeye Ravine, tributary to Kanaka Creek, in Sierra County, for mining and milling purposes. The water will be conducted to place of use by a pipe line 2100 ft. in length, and will be returned to Kanaka Creek after use.

NEW BULLETINS.

The Chicago Pneumatic Tool Company has just issued bulletins 266 and 130 on Railway Motor Cars and Lubrication of Pneumatic Tools.

Moloney Electric Company of St. Louis has published Booklet No. 160, illustrating and describing some installations of Moloney transformers throughout this country and Canada.

The General Electric Company has just issued the following new publications dealing with the subjects as listed: Bulletin No. 49300, Armored Cables; No. 48320, Speed-Regulating Rheostats and Panels for Direct Current Motors; No. 46104A, Type G Demand Meter; No. 46103A, Type M Demand Meters, and No. 46101A, Type P Demand Meters.

How far will a trolley car coast and how long will it take it to come to rest after the power is shut off? How quickly can the motorman stop his car by the use of brakes? How much current does it take to start an electric car? How fast will an electric car run under a given voltage of current? Does it take more or less current to run a car fast than slow? These questions and many others of a similar character have been studied by A. M. Buck of the Engineering Experiment Station of the University of Illinois and are answered in Station Bulletin No. 90 entitled "Some Graphical Solutions of Electric Railway Problems." Copies may be obtained gratis from W. F. M. Goss, Director, Urbana, Illinois.

TRADE NOTES.

The Westinghouse Electric & Manufacturing Company donated the use of a complete electric cooking equipment to the Cafe Belgique, which was recently held in conjunction with the Belgian relief work at the Exposition Auditorium, San Francisco.



NEWS NOTES



INCORPORATIONS.

POLSON, MONT.—The Valley View Telephone Company has been incorporated here.

IRVING, CAL.—The Union Telephone Company has been incorporated by W. Polders, C. P. Barnard, E. W. Zumwalt.

TACOMA, WASH.—The Sound Telephone & Telegraph Company has been incorporated with a capital stock of \$10,000 by W. C. King, A. and M. Oholson.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Central Counties California Gas Company, with a capital stock of \$500,000, by C. S. S. Forney, E. C. Hall, B. F. Silverstein, J. C. Wheeler, Jr., and W. M. Pigg. The incorporation of the new company is believed to be a preliminary move toward the acquisition of the Hanford Gas & Power Company by Forney and his associates, and it may lead to a consolidation of several San Joaquin Valley properties. Among other things a gas transmission main from Visalia to Hanford and thence to Armona and Lemoore in Kings County, is planned. A lateral branch from this main will serve Goshen, making a total of ten communities served in Tulare and Kings counties.

ILLUMINATION.

MYRTLE CREEK, ORE.—Bids will be received by the town recorder until December 5th for the construction of a water and light plant.

SUNNYSIDE, WASH.—Having been granted a 50-year franchise here the Pacific Power & Light Company has started changes in the lighting system.

FRESNO, CAL.—The trustees have accepted the bid of the Lewis Electric Company for the installation of an electrolier system on South J street. The bid was \$9575.

BERKELEY, CAL.—The city council has decided to ask the Pacific Gas & Electric Company to install conduits at no expense to the city and place 14 lights on Adeline street between Woolsey and Ward streets.

MERCED, CAL.—A design for the electrolier standard and lamp has been selected and the city engineer will proceed to prepare plans and specifications for the system, which is to be installed in the business section.

WAPATO, WASH.—The town of Sunnyside has granted to the Pacific Power & Light Company a 50-year franchise and the company has changed its lighting system now under way; and will erect a new office building in Sunnyside.

ALHAMBRA, CAL.—The Pacific Light & Power Corporation is seeking a franchise for lighting purposes in Monterey Park. Some opposition has developed, but with a few slight changes in the proposed franchise, the trustees expect to adopt it.

LOS ANGELES, CAL.—The city council has instructed the board of public works and the city attorney to prepare and present an ordinance for the ornamental lighting of Beacon street, in the San Pedro District, between Fourth and Sixth streets.

LOS ANGELES, CAL.—That the proposed new Broadway lighting system will cost in the neighborhood of \$50,000 and that it will require six months for installation are announcements made by W. D'A. Ryan, electrical expert, who is planning the new system.

TACOMA, WASH.—The Pacific Telephone & Telegraph Company will start work soon in extending its service south of Forty-eighth street and west of Sheridan street, at a cost of \$25,000. The work involves 136 poles and 20,000 ft. of aerial cable and miscellaneous underground work.

VISALIA, CAL.—The Mount Whitney Power & Electric Company has been awarded the contract for the construction

of a system of ornamental street lights for West Main street from Encina avenue to the city limits, on its bid of \$1450. Work is to be started within 30 days.

SEATTLE, WASH.—An ordinance authorizing the condemnation of three lots adjoining the city's steam auxiliary lighting plant to provide a site for a second unit has been passed by the council. The estimated cost of the second unit is \$400,000. Authorization of a bond issue is necessary.

LOS ANGELES, CAL.—Bids will be readvertised by the board of public works for ornamental lighting posts and appliances for Adams street from Grand avenue to Figueroa street, as the bids received were considered too high. They are: F. O. Engstrum, \$3818; John L. Wilson, \$3367; and D. S. McEwan, \$3950.

GLOBE, ARIZ.—At a meeting of the city council the question of a municipal lighting plant was revived when a report was made on a petition for an arc light at the corner of High and Apache streets, to the effect that it could not be granted because the plant of the Globe Light & Power Company is already taxed to capacity.

TRANSMISSION.

HOQUIAM, WASH.—The project to vote \$175,000 bonds for the purchase or condemnation of the distributing system of the Grays Harbor Railway & Light Company in Hoquiam or the construction of a plant for the city, was defeated.

CASHMERE, WASH.—Mayor Jones and the city council are considering the calling of a public meeting to hear expressions from the taxpayers on the proposition of issuing bonds for the purpose of constructing a municipal power plant.

ANGELS, CAL.—A transmission line is to be built into the Pioneer shaft of the Angels Deep Mining Company from the San Francisco & Sierra Power Company's main line at Altaville at once, as a precautionary measure, should the Brown-Smyth-Ryland deal fail to materialize.

BOISE, IDAHO.—An application for a certificate of convenience and necessity has been made to the public utilities commission by J. E. Goodman of New Meadows to furnish electricity to the towns of Donnelly, Arling, Cascade and the incorporated villages of Roseberry and Van Wyck. The proposed plant and transmission lines would cost \$12,000. The plant will be erected on the North Fork of the Payot River at Lardo.

TELEPHONE AND TELEGRAPH.

SANDPOINT, IDAHO.—Work will be commenced on the construction of sixteen miles of government telephone line to connect Moyle and Leona. The work will be under the supervision of J. A. Fitzwater.

OKANOGAN, WASH.—The Colville National Forest Department of Agriculture has applied to the Commissioners of Okanogan County for a franchise to construct telephone lines upon the county roads. The petition will be heard by the board of commissioners on December 5th.

MODESTO, CAL.—The territory including the country areas of the Modesto and Turlock irrigation district and the incorporated towns of Modesto and Turlock at the general election was constituted a public utility district for the express purpose of taking over all telephone lines and exchanges included in the area for operation as a municipal enterprise.

SALT LAKE CITY, UTAH.—The Mountain States Telephone & Telegraph Company plans to spend immediately in this district a total of \$310,000, divided as follows: Murray, \$120,000; Midvale, \$112,000, and Holliday, \$80,000. Three new exchange buildings, 110 miles of new poles and the

rejuvenation of an equal length of old time line poles, are included in the plans, according to C. C. Campbell, district manager.

FRESNO, CAL.—Authorization for more than \$10,000 worth of improvements to the valley division of the Pacific Telephone & Telegraph Company has been made. The work will consist of a rebuilt toll lead between Modesto and Fresno and the installation of central office equipment here. The toll lead will cost approximately \$6620. The central office work here will consist of switchboard apparatus to cost approximately \$4930 and will be completed in about 150 days.

TRANSPORTATION.

LOS ANGELES, CAL.—Recommendation that the Los Angeles Railway be allowed to rebuild its Temple street line in sections will be made to the board of public utilities. If approved the company will probably ask for a new franchise, the old one having expired.

SEATTLE, WASH.—Seattle's municipal street railways continue to lose \$2000 monthly, with a net loss of \$1985.47 in October, reported by A. L. Valentine, superintendent of public utilities. Total expenses for the two divisions amount to \$4410.90, as compared with \$3965.38 revenue. A total of 58,004 passengers was carried. Since the city light department took over the street railway substations, the power cost is being checked against the value of the substations, so that in October the street railways received \$1069.63 worth of power without cash outlay. The power cost added to the item of \$1593.86 for bond interest charged against the railways exceeds the loss by \$678.91. The interest payment, however, is checked against tax levy funds. The books of the municipal lines show more cash on hand now than last year.

IRRIGATION.

STOCKTON, CAL.—A contract to install a new pumping plant at the station on the east side of Yosemite Lake has been awarded to the Electric & Machine Equipment Company.

PORTERVILLE, CAL.—W. A. Kraner, of San Francisco, has been awarded the contract for the construction of the first unit of the Terra Bella irrigation district, to be completed by July 1, 1917, at a cost of \$376,000.

MONTAGUE, CAL.—Work on the big pumping plant that is to take water from the Shasta River and irrigate the lands in Grenada district is now going on rapidly and the pumps will be working in time for next season.

VALE, ORE.—At the meeting of the board of directors of the Warm Springs Irrigation District, held recently, it was resolved unanimously to advertise the sale of the entire issue of \$750,000. This will be done and the sale will take place late in December.

VICTORVILLE, CAL.—Landholders in the vicinity of Sheep Creek are planning to go ahead with an irrigation enterprise. It is believed a watershed in the vicinity of Sheep Creek will furnish a large amount of water. Estimates vary as to the amount which can be irrigated all the way from 15,000 acres to 50,000 acres. The project contemplates a dam about 1200 ft. long and 90 ft. high.

TWIN FALLS, IDAHO.—Louis C. Kelsey, consulting engineer, is now at Twin Falls, Idaho, making surveys of water supply, preliminary to preparing plans and recommendations covering the proposed extension to the municipal waterworks system contemplated in that city. It is expected that plans can be ready in February and actual work undertaken early next spring. The job is estimated to cost about \$300,000. Mr. Kelsey will not be back in Portland until next month.

REDDING, CAL.—Professor T. H. Keans of Berkeley, an expert on irrigation, has been engaged by the directors of the Anderson-Cottonwood Irrigation District to estimate how much more money they need to complete the system. It

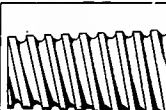
has been evident for some time that the money derived from the sale of \$480,000 in bonds would not be enough and because the price of materials has advanced so tremendously since the first estimates were made.

YUMA, ARIZ.—New plans are being made to unite Yuma and Imperial valleys in one reclamation service project, create a great storage dam and reservoir at Yuma with dam bulwarks to include Prison Hill, Yuma and Indian Hill, in California; spillway for waters to Mexican lands that would create vast electric energy and provide for power for pumping waters to mesa land and also for commercial purposes. The proposed project is estimated to cost from \$10,000,000 to \$25,000,000.

MADERA, CAL.—Actual work on the preliminary survey for the proposed Madera irrigation district will start at once, when Engineer Frank Clare and P. M. Stafford will take the field with a crew of men. Interest in the irrigation movement has been revived since the announcement was made that the negotiations with Miller & Lux had reached the stage where only the formal ratification of the tentative agreement was necessary to make it binding together with the surveying data which must be secured and presented before any action can be taken.

OAKDALE, CAL.—The Oakdale Irrigation District has partially solved its water shortage problem during the season of low water, and that without building a reservoir. A pumping plant will be installed, to handle the seepage with a 150 h.p. engine at the bridge, and this quantity of water will be lifted back into the canals for use a second time. It will cost about \$600 to operate the plant during the month when the water is low. This will greatly relieve the pressure on the flow available from the river, and if the plan is successful, other pumping plants may be installed further down the river to make a third use of the irrigation water.

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SAN FRANCISCO, DECEMBER 2, 1916

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ELECTRIC PUMPING EQUIPMENT ON THE STEAMER LA BREA.

BY HUGO P. FREAR.

ELECTRIC COOKING.

BY E. A. WILCOX.

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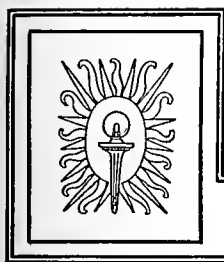
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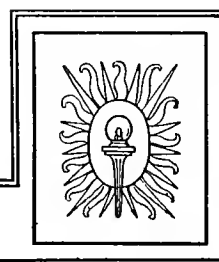
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VOLUME XXXVII

SAN FRANCISCO, DECEMBER 2, 1916

NUMBER 23

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ELECTRIC PUMPING EQUIPMENT ON STEAMER LA BREA

BY HUGO P. FREAR.

(In view of the tremendous increase in shipbuilding on the Pacific Coast recently, this article should be of widespread interest. It gives details of the steam turbine drive and electrically driven oil pumps with which the vessel is equipped. It is slightly condensed from a paper presented at the November 15th meeting of the Society of Naval Architects and Marine Engineers in New York City.—The Editor.)



Fig. 1. S. S. La Brea in Ballast Trim.

The S. S. La Brea is the first oil tank steamer equipped with independent submerged cargo pumps in each compartment, port and starboard, operated by electric motors on deck, and also the first to be fitted with reduction gear turbines, so far as the writer knows. Otherwise the vessel differs little from many tankers built on the Isherwood longitudinal system of framing, and therefore these two items, especially the electric pumping system will receive the most attention.

The La Brea is 435 ft. in length, 56 ft. in breadth and 33 ft., 6 in. in depth, moulded, and was the first vessel of this particular class built by the Union Iron Works Company, San Francisco. The contract was dated May 14, 1915, and delivery made February 29, 1916.

There have since been completed or contracted for, by the same builders, thirteen additional tankers off the same scribe, all with pump rooms and ordinary pumping systems except one vessel for the Pan American Petroleum Transportation Company, which will have the same pumping system as the La Brea, but with only one pump to each transverse cargo compartment in lieu of two as fitted on the La Brea.

Ten of these additional tankers have reduction gear turbines and three triple-expansion reciprocating engines of approximately the same indicated horsepower as the shaft horsepower of the turbines. In

each case the length of machinery space, forehold and overall length of the oil compartments, including pump room and coffer-dams, are the same. The position of the pump room, coffer-dams, length of fuel tank and length of some of the cargo tanks vary more or less to suit the owners' views.

Of this class, the tanker following the La Brea was the Los Angeles, also for the Union Oil Company of California, but fitted with triple-expansion reciprocating engines, pump room and ordinary pumping equipment of standard capacity and efficiency. These two vessels, delivered within a month of each other and owned and operated by the same company, offer a most excellent opportunity for a comparison of their performances on the voyages so far completed.

For a general description of the La Brea the reader is referred to Fig. 1, showing the vessel afloat, and Fig. 2, showing profile inboard. On account of the limited scope of this paper, attention is called only to the reduction gear turbines and location of cargo pumps and motors indicated on the profile inboard and upper deck. Tanks 1, 2 and 3, are much smaller than the remaining tanks and have an independent discharge line. These were intended for light distillates, but have not been used for that purpose up to the present time.

The propulsion equipment was furnished by the General Electric Company and consists of a Curtis turbine of the type developed for ship-propulsion work.

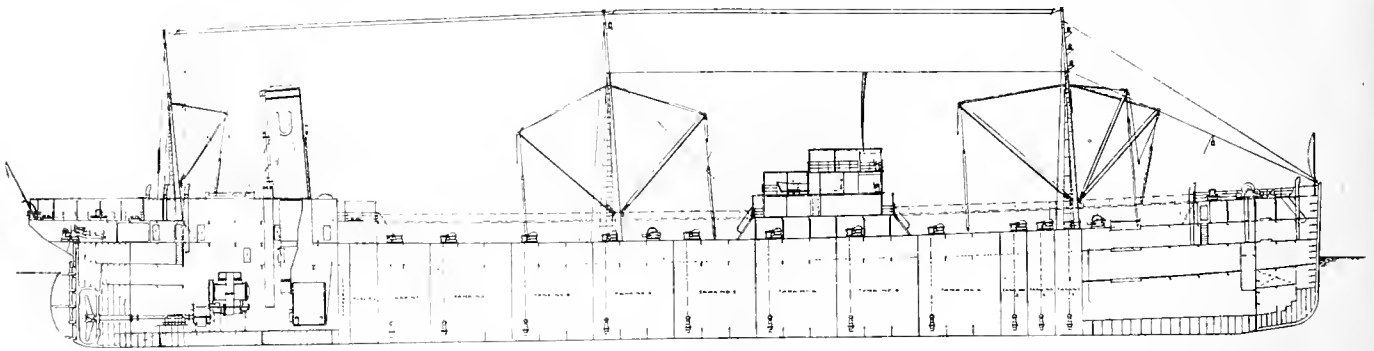


Fig. 2. Inbound Profile of S. S. La Brea.

operating at a speed of 3500 revolutions per minute, direct-connected to a double reduction gear suitable for reducing the speed of the turbine to 90 revolutions for driving the propeller (see Fig. 3). The normal rating of the turbine and gear is 2600 brake h.p., with a steam pressure of 200 lb. at the throttle valve, 50 deg. super-heat and exhausting into a vacuum of $28\frac{1}{2}$ in., measured at the exhaust inlet with the barometer at 30 in.

The steam turbine consists of a forward 5-stage element and a 2-stage reversing element mounted on the same shaft and exhausting into the same chamber. Control of these turbines is affected by means of a throttling lever actuating balanced valves located respectively in the steam lines to the ahead and reverse turbines. Speed of the turbine is controlled by throttling, and there is also provided a hand-operated stop-valve in the reverse line which is normally kept closed while at sea, in order to prevent any possibility of leakage of steam into the reversing turbine. This valve is opened when it is desired to maneuver or make a landing.

The ahead turbine consists of five Curtis stages as stated above, the first or high-pressure stage carrying two rows of buckets and the remaining stages a single row of buckets. The buckets for each stage are mounted on a rolled steel plate wheel, into the periphery of which the buckets are dovetailed in a manner developed by the General Electric Company and successfully used for many years to meet the severe requirements of central station turbines. Steam enters each stage successively through nozzles carried in the diaphragms between each stage.

The reversing turbine is of the same construction as the head turbine, with the exception that it consists

of two stages only, of smaller diameter. The reversing turbine is capable of developing two-thirds torque and two-thirds speed with the same steam flow taken by the ahead turbine under normal operating conditions. The nozzle capacity, however, is greater than that of the ahead turbine, so that the requirement of reversing power may be considerably exceeded under normal operating conditions.

The reduction gears are of the helical type and arranged to give two speed reductions, the high-speed reduction ratio being 5.03 and the low-speed reduction ratio 7.75, making a total reduction ratio of 39.1. The high speed or driving pinion meshes with the two gears, one on each side, the three shafts lying in a horizontal plane. The low-speed pinions are mounted on the same shaft as the high-speed gears. The adjustment is such that work is divided equally between the two low-speed pinions.

The high-speed gears are built in accordance with the "Alquist" patents and consist of a number of rolled steel plates, each 1 in. thick and thinned out near the center in order to give a certain degree of flexibility, thus insuring equal distribution of the work through the total face of the teeth. This construction has been found not only to give smoothness and lack of noise in operation, but has also resulted in a great reduction in the wear of the gears and pinions.

Slip couplings are provided between the high-speed gears and low-speed pinions in order to prevent any movement of the main thrust shaft being transmitted to the turbine.

The turbine bearings and gears are supplied with oil under pressure of about 10 pounds. The oil is circulated by means of steam pumps which take oil from the main tank, where it is first forced through a strainer and then through a cooler before being delivered to the turbine bearings and the spray nozzles delivering oil to the gears. Oil is also supplied under pressure to the various bearings of the gears and pinions.

The complete weight of the turbine and reduction gear, including all parts for the throttle valve and thrust shaft coupling, is about 110,000 pounds.

The electric cargo pumping system is the result of much labor and study on the part of Mr. O. B. Kibele, general superintendent of transportation for the Union Oil Company of California, who, with the able assistance of the San Francisco office of the General Electric Company, perfected all of the details.

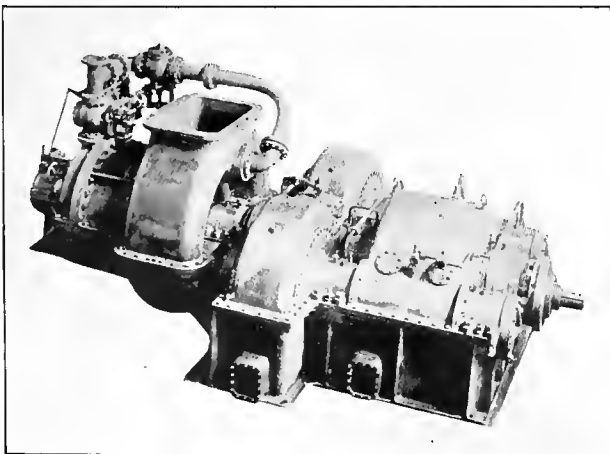


Fig. 3. Assembled Reduction Gear Turbine, 2600 h.p.

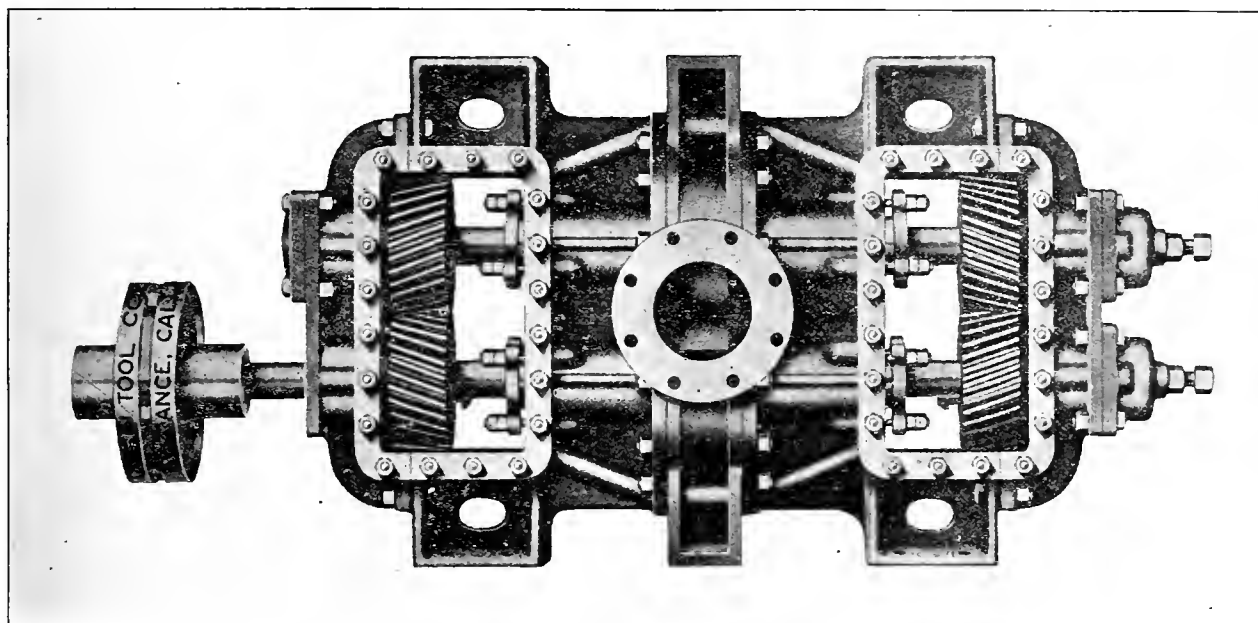


Fig. 4. 4-in. Ideal Rotary Pump with Gears Exposed.

The writer is indebted to both for much of the material worked into this paper.

The installation consists of twenty-two Ideal 4 in. rotary pumps, built by the Union Tool Company, Torrance, California, (Figs. 4, 5), and are designed especially for handling highly viscous oils, molasses and creosote, and are also fitted with a steam jacket for handling asphaltum. Each pump can deliver 350 gal. per minute against a total head of 350 ft. at 200 revolutions per minute. The pumps are secured in the bottom of each compartment of the vessel, port and starboard to brackets that are integral with the tanks, and are driven by 40 h.p., 3-phase, 60-cycle, 220-volt motors. The discharge line for the three small tanks forward have nine 4 in. discharge gates, while the separate discharge line for the remaining tanks have fourteen 6 in. discharge gates.

The motors are located on the upper deck contained in a watertight and gas proof casing (Fig. 6). The drive to the pumps is through a set of bevel reduction gears and a vertical shaft which transmits the power through flexible couplings to the pumps.

The shaft is entirely enclosed in a casing which serves as an oil reservoir, so that all of the shaft bearings and the pump gears are operated in an oil bath.

The pumps are each fitted with enclosed carbonized spiral gears, top and bottom, and operate with a minimum of noise. The vertical-drive shaft is hung on a ball thrust bearing contained in the gear case. They are fitted with 6 in. suction and 6 in. discharges, so arranged that each pump can take suction from either or both compartments, port and starboard, at the same time, or independently. Cargo may also be discharged with one pump or as many pumps as can be put into operation at one time, depending entirely on the capacity of discharge pipes to the shore tanks. Any number of commodities can be discharged at the same time without mixing, depending, of course, on the number of discharge lines that are available to the shore tanks. The discharge lines from the pumps

are so arranged that they can be also used as filling lines to each individual tank, by means of a bypass round the pump.

Both Mr. Kibele and the writer, from the start, believed that half the number of pumps would meet all requirements, but finally decided to take no chances on the first installation. The better and more economical plan would be to connect the smaller number of pumps to a common 6 in. suction line, fitted with gate valves at each bulkhead and independent suction to each tank. This would enable each pump to draw from all or any of the tanks and insure maximum elasticity in the event of one or more pumps going out of commission.

All operating valves are located on the upper deck. The motor control for starting the pumps is located in the main engine room and will be described in more detail hereafter. When it is desired to start any par-

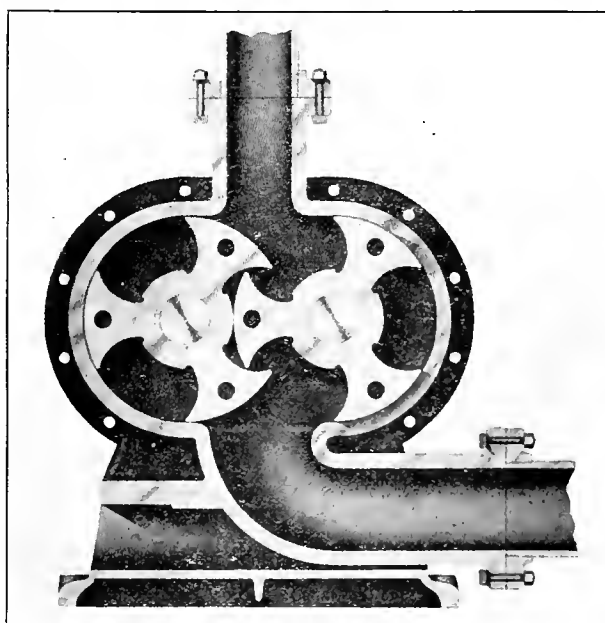


Fig. 5. Ideal Rotary Pump Rotors.

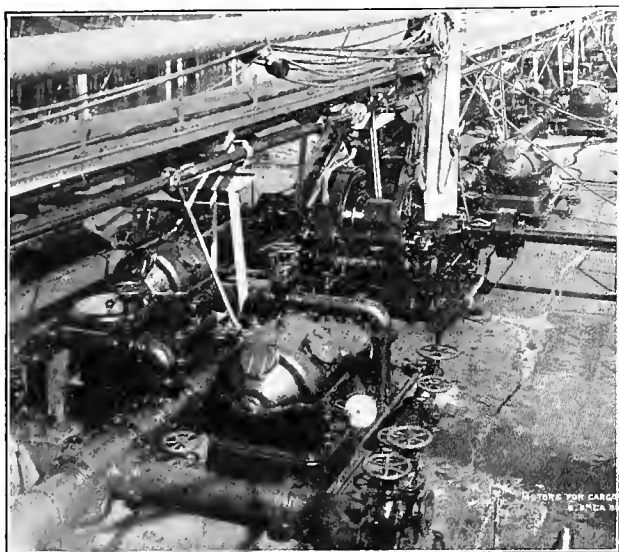


Fig. 6. Pump Motor Installation.

ticular pump, the deck officer gives the signal to the operator in the engine-room. Pumps are thus under direct control at all times by the engineer on watch.

Since the *La Brea* went into commission she has handled over 500,000 barrels of oil, and in each case the discharge was completed with a material saving in time as compared with vessels with ordinary pumping system.

The capacity of the pumping system is of course, regulated by the capacity of the discharge lines and the pressure that the pumps are subject to. On a low-discharge head, and with ample shore connections the entire cargo could be discharged in approximately 10 hours' time. The maximum quantity of oil handled per hour against a pressure of 110 pounds per square inch is reported to be 4200 barrels.

The economy in fuel saved with this pumping installation appears to be approximately 45 per cent over the ordinary manner of discharging a liquid cargo.

After it was determined to use this system of pumping, with a pump in each individual tank, the most logical way of driving the pumps was by independent electric motors. In determining the proper type of motor, several propositions were considered. Inasmuch as the drive of the pump was vertical, both vertical and horizontal motors were considered. Twenty-five cycle would have permitted using a slow-speed vertical motor suitable for direct connection to

pump without any gearing, but this necessitated the installation of special 25-cycle turbine generating sets. The higher speed of 60-cycle motors required connection to pump through vertical gears if vertical motors were used, and this was not considered practical. The horizontal motors, whether 60 or 25-cycle, required the use of bevel gears. All the power companies operating on the Pacific Coast and the various refining and loading stations of the Union Oil Company use 60-cycle, and the installation of 60-cycle motors had the advantage of being able to use shore power to drive the cargo pumps if required. For this reason, and also on account of long shipments required for the vertical 25 or 60-cycle motors, it was decided to use the horizontal 60-cycle type.

Work had been progressing very rapidly on the hull construction, but the motors and generating apparatus could not be ordered until after the amount of power required to operate the pump had been determined. An experimental pumping plant was installed, and it was some time before the data were available, with the result that shipment became very important and was the deciding factor why certain types of motors, etc., were selected. The cargo motors are installed, as previously stated, on the main deck, exposed to weather conditions and salt water, and so it was decided to use the open type and to enclose same in a water-tight casing supplied by the builder.

Ordinarily the pumps and motors would be required to start up against line pressure, and this would necessitate a high-starting torque slip-ring motor with its necessary starting resistance and controller. With this type of motor there is sparking at the collector rings and the controller fingers, and, as the motors would be installed on deck where explosive gases might be present, it was not considered practicable to use the same; consequently it was decided to use the ordinary squirrel-cage type. This motor, however, does not have torque sufficient to start a pump against full line pressure, and it was necessary to install a bypass on the cargo pumps. Pumps are brought up to full speed with the bypass open, which is gradually closed, at the same time opening up the valve in the discharge line.

As already stated, there are twenty-two of these cargo pumps, and each is equipped with a motor of the following rating: 40 h.p., 600 r.p.m., 3-phase, 60-

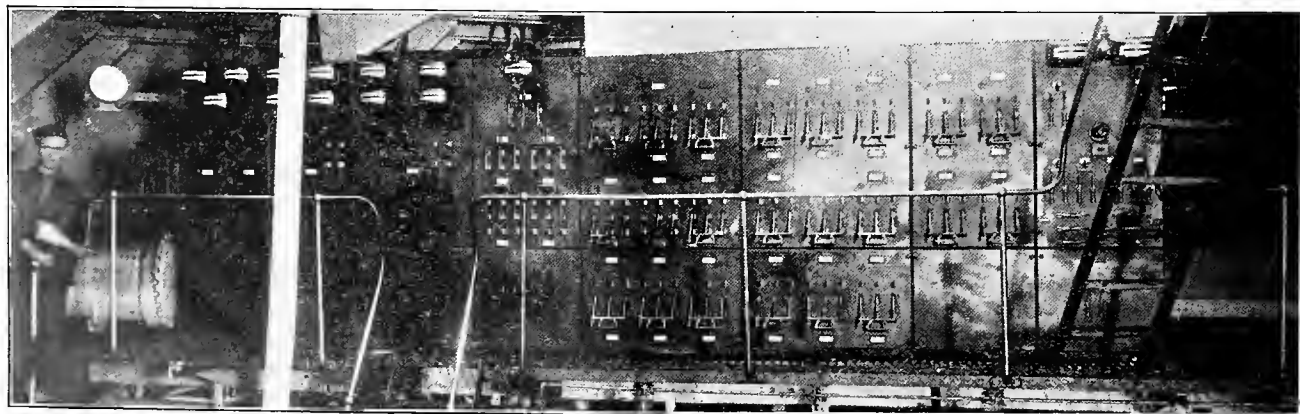


Fig. 7. Switchboard.

cycle, 220-volt, horizontal, squirrel-cage of the open type construction.

The motors are enclosed in a water-tight casing, as stated above, and this was made of cast iron. When loaded it is necessary for the motors to have proper ventilation, and the enclosing case is equipped with several hand-hole covers, which are opened when the motor is in service (Fig. 10). The motors ordered for the next installation are exactly the same, except they are enclosed and no additional water-tight casing will be required.

In addition to the cargo pump motors, the following motors were installed in the engine-room, depending on the same power plant:

One 60 h.p., 720 r.p.m., 3-phase, 60-cycle, 220-volt, horizontal open-type motor, direct connected to circulating pump for main condenser.

One 35-h.p., 1800 r.p.m., 3-phase, 60-cycle, 220-volt, motor, direct connected to one boiler feed centrifugal pump.

One 36-h.p., 1800 r.p.m., 3-phase, 60-cycle, 220-volt, motor, direct connected to centrifugal ballast pump.

The power plant is located on a gallery over the thrust shaft at the after end of the engine room and consists of two turbo-generating sets.

One 375 k.v.a., and one 125 k.v.a., 3600 r.p.m., 3-phase, 60-cycle, 240-volt, generators, direct connected to General Electric Curtis condensing turbines, with direct connected exciter.

These turbines exhaust into the auxiliary condenser, but it is also arranged so that they can exhaust into the main condenser. While discharging, the larger turbine is of sufficient size to operate nine pumps at about 140 lb. pressure, and for general purposes this is the maximum number of pumps that can be operated at one time with present shore discharge lines. However, necessary arrangements are made to operate both generators in parallel, making a total capacity of 500 k.v.a.; this would permit the operation of eleven to twelve pumps at the same pressure. In case of any trouble with the large turbine, the smaller unit could be used to operate two to three of the cargo pumps. When at sea, the 125 k.v.a. turbine is used, exhausting into the main condenser; this turbine is of sufficient size to operate the boiler feed, main circulating pump and lights. In case of any trouble with the 125 k.v.a. turbine, the larger turbine could be used. With the above arrangement there is always one turbine available as a spare.

For furnishing lights, there are supplied two transformers stepping voltage down from 240 to 120. To furnish the necessary power for the lights when both the above turbines are shut down, there is a small 5-kilowatt, 125-volt engine driven, direct connected generator available.

The switchboard is shown in Fig. 7, and is installed on a gallery on the starboard side of the engine-room. Starting from left to right, the switchboard consists of the following:

One swinging bracket, one synchronizing device, used for paralleling the two turbines and the voltage regulator.

Panel 1 controls the two direct connected exciters of the turbine sets.

Panel 2 controls the 125 k.v.a. generator set.

Panel 3 controls the 375 k.v.a. turbine set.

Panel 4 controls the feeder lines to the motors in the engine room and the compensators used for starting the cargo pump motors.

Panels 5, 6 and 7, control the twenty-two circuits to the cargo pump motors.

Panel 8 is the lighting panel and controls the five kilowatt generating set and the auto transformers which change the voltage from 240 to 110. It is so arranged that lights can be operated either from the main generating sets or the small auxiliary five kilowatt set.

One of the novel features in connection with this installation, and which is part of the switchboard, is the method of starting the cargo pumps. Ordinarily, the practice is to use a starting compensator with each squirrel-cage motor. For various reasons it was not considered advisable to use any starting devices where the circuit would be made or broken on the upper deck, on account of possible presence of explosive gases, and a scheme was worked out by which all the motors were started from the engine room switchboard.

Arrangements were also made to start all motors from two compensators, one of which is a spare. This is accomplished as follows: The three panels, 5, 6 and 7, controlling the cargo pump motors, have running and starting buses, the running bus energized direct from the generators, and the starting bus through the compensators. The starting bus is not energized until the contactor at bottom of panel 4 is closed. The switches starting the motors are triple pole, double throw. The upper contacts are connected to the starting bus and the lower contacts to the running bus. When the switch is thrown into the upper position, the blades engage the contacts, but no power is available until the switch is pushed all the way in, which closes a small auxiliary contact, which in turn closes the main contactor on bottom of panel 4. This in turn energizes the starting bus through the compensators and the motors start. An ammeter is installed in the starting circuit, which indicates when the motor is up to speed. When the motor is up to speed the motor switch is thrown into the lower position—that is, on the running bus—and the motor is then operating on full voltage. When throwing the motor switch from the upper to lower position, the auxiliary contact is the first to open, which in turn opens the main contactor, with the result that the making and breaking of the starting current is made on the main contactor. Each motor circuit is supplied with three fuses, installed on rack back of the switchboard to protect the motors from overload.

In order that the searchlight could be operated from the main alternating current generators or the five kilowatt direct current auxiliary generator, the direct current mechanism was removed from the searchlight and replaced with a high power concentrated filament incandescent lamp. This was tried out and worked very satisfactorily.

The data from logs on voyages to date, for the La Brea and Los Angeles give a general idea of the com-

parative performances of the two vessels and their equipment. The methods employed by companies in measuring oil into and out of a vessel sufficiently guarantee the accuracy of these data for general comparison.

Comparing the time in port discharging, and barrels of oil discharged per hour for the first six voyages, the La Brea was in port 36.4 per cent less time and discharged 55.4 per cent more oil per hour than the Los Angeles. If we reverse the order, it will be noted that the Los Angeles was in port 57.90 per cent more time and discharged 35.67 per cent less oil per hour than the La Brea.

In one case where the destination in each case was Antofagasta, Chili, and the Los Angeles preceded the La Brea by two days, notwithstanding the La Brea had been out of dock a month longer than the Los Angeles and a greater time in warm water, it is stated that she could have overhauled the Los Angeles and discharged first had the contrary not been arranged.

The La Brea consumed 17.09 per cent less fuel steaming, 42.47 per cent less fuel in port, 44.92 per cent less time in discharging, 17.43 per cent less fuel per knot steaming, 17.92 per cent less fuel per knot steaming and in port, and discharged 83.65 per cent more barrels of oil per hour.

STIMULANTS.

**For the Benefit of the Workers and Their Friends,
the Bosses.**

Big jobs are only a lot of little jobs assembled.

The bigger things are easier to do than the smaller things—and there's less competition.

Many a "live" prospect has been killed by a "dead" salesman.

Business is the science of Human Service.

There are more opportunities today than there are men.

Society's problem: The High Cost of Loafing.

Don't make excuses—make good.

Some salesmen spend more time in hoping for orders than in working for them.

The successful man is the one who does a thing while the other fellows are holding committee meetings deciding whether or not to do it.

Success doesn't mean getting ahead of competition so much as getting ahead of yourself.

A smile is more contagious than a scowl—and much better for those around you.

Standing still is only death in another form. Trying to save funeral expenses is about the only excuse some people have for living.

And finally, work wins; you can't beat it!

—Norval Hawkins, in *Manufacturers' News*.

SHIPBUILDING ACTIVE ON THE PACIFIC COAST.

There is great activity in shipbuilding on the Pacific Coast. At the present time steel and wooden ships are being built on the Willamette and Columbia rivers which will cost more than \$22,000,000. Oregon is peculiarly equipped with material for wooden ships, its timber being sent all over the world for this purpose. Shipbuilding operations of large proportions are under way at practically every port on the Coast.

WATERPOWER'S PRESENT STATUS.

(This summary of the facts leading to the present deadlock in waterpower development both on navigable streams and on the public lands, has been summarized from literature issued by the Waterpower Development Association of Washington, D. C. In brief compass it reviews the salient features of the deplorable situation which Congress is expected to relieve at its next session.—The Editor.)

Approximately 6,000,000 h.p. of hydro-electricity has been developed in the United States. The U. S. Geological Survey estimates that about 60,000,000 h.p. remains undeveloped. It is estimated that perhaps 15,000,000 of this undeveloped water power could in the near future be economically and profitably developed and used if the laws permitted. Water power cannot be utilized to advantage excepting where it can be generated and delivered at a lower cost than fuel power. The cost of installing water power plants is generally from two to three times that of installing steam plants and the interest on this additional investment in many instances amounts to more than the cost of fuel and operation in steam plants. In many sections of the country steam power is cheaper than water power because of this larger interest cost.

There are a number of large water powers undeveloped in the United States, the use of which is controlled by the federal government, at which hydro-electricity could be generated at very low cost. There is demand for this low priced power for many uses to which cheap power is essential. Electro-chemical industries, including plants for the fixation of atmospheric nitrogen, extensively used in manufacture of explosives and fertilizers; electro-metallurgical establishments, such as electric furnaces for reduction of ores and manufacture of electric steel; electrification of railway main lines; irrigation of arid lands by pumping systems, etc., all these are dependent upon very cheap power. The only power that can be developed cheaply enough to make such uses profitable is water power and the only water powers which can be developed cheaply enough to use to advantage for these purposes are now debarred from use by the inapplicability of existing federal laws.

Practically all of the power sites in private ownership that have a present development value have been developed. About 85 per cent of the undeveloped water powers in the United States are under control of the federal government. These powers include practically all of the possible large developments. The water powers under federal control divide into two groups:

1. Water powers on navigable streams.
2. Water powers on non-navigable streams in the public domain.

The United States does not claim to own any of the flowing waters which comprise either of these groups of potential energy.

Power Developments on Navigable Streams.

In the navigable streams the waters and the river beds are owned either by the states or by private riparian owners. The only control Congress has asserted over these streams is the power to regulate their use for purposes of navigation. That is, the govern-

ment cannot and does not propose to sell or lease or give away the waters in these streams, or the beds of the rivers. Congress has claimed no right or power to regulate or allow power developments in such streams except as these power developments may have a relation to the navigability of the waterways.

Very early in the history of the country the right of the United States to prevent or to permit and regulate obstructions in navigable streams was settled by the Supreme Court in an opinion by Chief Justice Marshall (*Wilson vs. Black Bird Creek Marsh Co.*, 2 Pet. page 245, 249 to 252). This power, however, was not exercised with regard to dams until 1890. Up to that time dams were commonly built under state laws. In 1890 national authority over the erection of dams in navigable streams was asserted in two sections of the Rivers and Harbors Act and for several years thereafter Congress from time to time passed special acts permitting construction of a few dams across navigable streams.

The first general dam act was passed in 1906. This act laid down certain general regulations to apply to all dams subsequently authorized by Congress, but Congress retained the sole authority to grant the permit in each case. In the first session of the Congress following its passage about twenty special acts were passed. In the ensuing year three such acts were passed, but the dispute over terms had already been resumed. An act authorizing a dam in Rainey River, Minnesota, under the provisions of the general act, was vetoed by the President and passed by Congress over his veto. This was immediately followed by the veto of a bill for a dam in James River, Missouri, which put a stop to the passage of enabling acts under the general act of 1906, excepting for one act passed in 1909 extending the time for the completion of a development in the Rock River in Illinois.

Following the Presidential vetoes of 1908 the question of general dam legislation aroused much interest and discussion and resulted in several amendments to the general dam act which were approved June 23, 1910. The amended act, however, while again intended to provide general laws governing all dams, still retained in Congress the sole authority to issue the permit in each separate case. The 1910 act was not even as effective in securing uniformity and development and quieting controversy as had been the act of 1906, and its provisions were even more burdensome to water-power enterprise. Nevertheless, numerous applications were made to Congress for permits under the act and fourteen bills were passed, chiefly extending the time for the beginning or completion of projects already authorized. One omnibus dam bill providing for fourteen dams was passed by both Houses but died in conference, it being understood that if it was passed the President would veto it. The Coosa River dam bill, authorizing the construction of a dam in Alabama under the provisions of the general act of 1910, and without any additional requirements, was passed by both Houses in 1912, but was vetoed by the President. This ended all attempts to secure from Congress authority for dams under the act of 1910. Since this veto no enabling acts whatever have been passed authorizing dams in navigable rivers.

Under the act of 1906 twenty-five subsequent enabling acts were passed. Under these enabling acts only six plants have been constructed, and the remainder of the permits have lapsed under the time limitations, presumably because the projectors could not finance under the terms of the act. Activity in water power development throughout the country has increased enormously since 1910, but under the present law, passed in that year, the applications for permits to construct dams on navigable streams have been less in number than they were from 1906 to 1910. Under the 1910 act Congress has passed only fourteen enabling acts, and only two power plants have been constructed under them. Reducing the thing to percentages, the percentage constructed under the act of 1906 was twenty-four, while that under the act of 1910 has been fourteen. Two of the plants referred to as having been constructed under the act of 1906 were made financially possible because, in one case, of a very large and unusually profitable market which surrounds the risk; and, in the second, of the fact that the plant was but a small adjunct to a large power system held in fee, and the fee properties were made a lien under the bonds, the company being placed in a position where it had to have more power or acknowledge its failure to supply its customers. The total capacity of the plants constructed under the acts of 1906 and 1910 is less than 140,000 h.p.

The Pending Waterpower Bills.

Two bills dealing with water powers on navigable streams were introduced before Congress at its last session. The Shields bill passed the Senate and the House Committee on Interstate and Foreign Relations reported the Adamson bill as a substitute measure. The provisions of these bills have been thoroughly ventilated in these columns and as there was such a wide difference in them, they were referred to a joint conference committee of both branches of Congress for report to the next session.

Power Sites in the Public Domain.

In the public land states of the West there are many undeveloped water powers on non-navigable streams. Congress has no control over the waters in these streams, nor their use. These waters are under state control, and nobody can use them except by complying with the state laws. No permit or consent is necessary from the federal government to erect dams in these streams. The only control possessed by the federal government over these water powers lies in the fact that it owns much of the land in this part of the country, and where all or part of the land needed for a dam abutment, for a power house site, for overflow by a storage reservoir, or as a right of way for a transmission line, is within a national forest, national park, national monument, or elsewhere in the public domain, the power company which plans the development must buy or lease from the government the lands needed for the purposes enumerated. In former years there was little or no trouble about this. It was considered that the control of the water was the important consideration in developing water power, and that the acquiring and use of the land was merely incidental. At the outset of the conservation agitation a number of

years ago, however, all remaining undeveloped power sites on the public lands were withdrawn from entry under existing laws, and have remained withdrawn and locked out of use, awaiting the enactment of legislation that would permit of their disposal and use.

The only law under which the use of such power sites, rights of way, etc., can now be secured, is the act of February 15, 1901, which allows the Secretary of Agriculture to grant permits for use of power sites in the national forests, and the Secretary of the Interior to grant similar permits for use of sites in the national parks and other parts of the public domain. Permits so granted are revocable in the discretion of the secretary of the department by which they are issued. A number of developments were begun under such permits, in the belief on the part of power companies that the government would never revoke these grants. In 1909, however, James R. Garfield, then Secretary of the Interior, revoked twenty-five of these permits two days before he went out of office, without notice of hearing, jeopardizing millions of dollars which had been invested in good faith in these undertakings. Since then no waterpower developments of any magnitude have been made under this form of permit. A comparatively few small plants have been built in the national forests, but it has been impossible to finance projects for the development of any large powers that would provide the cheap electricity needed for the establishment of new electro-chemical and electro-metallurgical industries, the electrification of trunk line railways, irrigation of arid lands by pumping, etc.

In the last eight or nine years a number of measures have been introduced in Congress for the purpose of permitting these power sites to be occupied under conditions which would make their financing and construction possible. One group in Congress has insisted on terms so restrictive as to be unworkable, while another group has insisted that the United States should turn over all power sites and other public lands and resources to the individual states without restriction, and between these two schools of extremists it has been impossible to pass any legislation. In the meanwhile water power construction has come practically to a standstill and capitalists willing to invest money in great developments and new industries that would give the country the benefit of new scientific inventions and processes, have been compelled to stand aside, helpless to do anything, because it has not been safe to invest the hundreds of millions necessary for such developments under present federal laws, and the states have no authority to permit use of the power sites.

The Ferris bill for leasing power sites in the public domain was passed by the House of Representatives and the Myers bill was introduced as a substitute measure in the Senate. These bills are now in the hands of the conference committee.

It is a consummation devoutly to be wished that as a result of these controversies that Congress will pass bills giving this greatly needed relief. The industrial development of the West particularly has been greatly retarded because of the lack of legislation giv-

ing investors confidence in the security of their investment.

AN ANTI-STRIKE PLAN OUTLINED.

The Merchants' Association of New York has sent to other commercial organizations throughout the country copies of a pamphlet containing the resolutions adopted by the association in support of the plan for preventing the interruption, by strikes, of the operation of public utilities, together with an outline by Henry R. Towne, of New York, telling how the plan might be carried into effect.

Briefly, it provides for the enforcement of a contractual relation between employers and employees on public utilities. It is suggested not so much as a final solution of this important question, although the Merchants' Association hopes it may prove to be such a solution, but as a means of bringing the matter forward for discussion. The Association has asked the Chamber of Commerce of the United States to submit the question to its constituent members in the form of a referendum in order that the sentiment of the business men of the country may be ascertained. It has also asked other organizations to join in requesting such a referendum.

The Merchants' Association has declared in favor of giving the federal government, through the Interstate Commerce Commission, control over railroad rates and regulation within state limits. This would do away with a large number of vexatious matters arising from the conflict between federal and state authorities over lines of transportation. The Merchants' Association is in favor of the federal incorporation of railroads; federal supervision of the issue of securities by interstate carriers; the enlargement of the Interstate Commerce Commission so as to enable it promptly and adequately to perform its functions; and strongly opposes government ownership of public utilities.

THE COST OF COAL.

At the recent American Mining Congress which met at Chicago, George Otis Smith and C. E. Leshner presented facts of vital interest to power men the country over on the subject of the cost of coal. The authors advocate the interstate regulation of the cost price of the commodity.

As coal is more an interstate than intrastate commodity, any regulation of prices needs to be under Federal control, and to benefit both consumer and producer such control cannot stop with transportation and mining costs but must stand ready to exercise full rights as a trustee of the people over the coal in the ground.

Public regulation, however, will be fair and indeed in the long run will prove beneficial to the landowner as well as to the consumer, to the mine worker as well as to the operator, because any such agency as the Federal Trade Commission, in its control of prices, must determine costs; and as we interpret the present attitude of the whole coal-mining industry, the operators are willing to rest their case on a fair determination of actual costs on which their profits may then be figured.

ELECTRIC COOKING.

BY E. A. WILCOX.

The March of Progress.—Modern civilization's advance may be clearly indicated by the progress in methods of cooking. Wood was the first material to be used as a fuel. Water was boiled in a kettle suspended over a log fire and meats were broiled on a spit, or roasted in the embers, for many hundreds of years. When it was found that coal produced a more uniform and hotter fire, and was far more desirable than wood, another era of progress was marked. The old fashioned fire place gave way to the more modern kitchen range. Then came fuel gas, which may be considered a product of coal, and the gas stove made its appearance. Although the use of gas obviously involved more danger and was somewhat more expensive, it was found to be quicker and far more convenient.

Crowning success was achieved, however, when the electric method was perfected, and the bridging of space between the historic fuel fire and the modern heat produced without flame was accomplished.

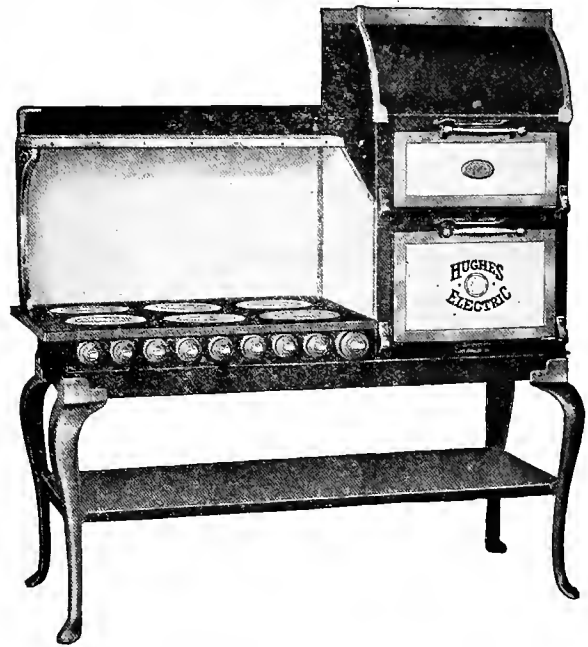
Advantages of Electric Cooking.—The extent of the improvement brought about by the electric range is almost unbelievable. The heat is under absolute control. The operator knows and commands the temperature at all times. The wasting of heat has been reduced to a minimum. The units or burners generate the heat right where it is used, and very little loss takes place. The heat utilized in the oven is generated on the inside, and as its walls are heavily insulated with material of low thermal conductivity, there is practically no opportunity for useful energy to escape.

Facility of Operation.—The electric range is easier to operate and can be regulated with a much greater degree of accuracy and certainty than the fuel range. Being clean, safe and labor-saving, its use promotes greater cleanliness and comfort. It produces no excess heat, smoke or fumes to vitiate the atmosphere, and does away with the constant attention and anxiety of the fuel fire. Cooking utensils, furthermore, may always be kept clean and free from smoke and soot on both the inside and outside.

Uniformity is attained in the electric range because it will always produce the same results under the same operating conditions. For instance, the oven has to be opened but twice for each operation—once when the food is inserted, and again when the cooking is completed. The operator has only to watch the clock while the food is cooking. This advantage partially removes the objection that many persons have to a low oven, which, with fuel stoves, requires constant bending over to examine the condition of the food. Any housewife, of even moderate intelligence, should be able to master the essential features of the operation of an electric range in a short time by simply reading the card of instructions that is sent out by the manufacturers with each range.

Special Advantages.—The individual operations in oven, insures even baking and browning. It will bake bread, cake, and pies that are most attractive in appearance. They will always have just the right color, will contain more nourishment, and remain fresh longer. Roasts should always be prepared in an open which the electric range outclasses every known type

of fuel stove, are baking, roasting and broiling. The heat being uniformly distributed in all parts of the

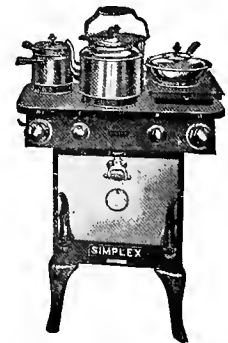


Hughes No. 60 Range (for Large Family Use).

pan containing no moisture, and basting is unnecessary in the electric oven. Sufficient moisture and meat greases will collect in the pan during the operation to prevent burning, and to provide material for gravy. The roast itself will come out of the oven uniformly browned on top, bottom and sides, if no basting is done. In both roasting and broiling operations the meat is seared, thereby retaining its natural juices, and making it more delicious, nutritious and attractive to serve.



Model G Hot Point Range.



Simplex 5-K Range.

Reduction in Meat Shrinkage.—Many experiments have been made in actual practice to show that there is less shrinkage in meats prepared electrically than by any other means. The meats sear over as soon as placed in the oven; there is no burning away of the fats and juices; and a saving of from 15 per cent to 18 per cent in the actual weights of the meats is effected. The tremendous economy in household expense that is made possible by the use of the electric range is apparent if we consider a family whose meat bill has averaged \$15 per month and a saving made of 15 per cent in the meat shrinkage by the use of electricity. Meat costs in this family would be reduced \$2.25 per month with the exercise of no additional self denial.

Assume an eight pound roast is placed in a 1600

watt electric oven and roasted $2\frac{1}{2}$ hours. The current consumption at high heat would be 4 kilowatt hours, but by proper manipulation of the oven switch not over half this amount, or 2 kilowatt hours, would be actually consumed. The saving in weight of the meat over gas or coal cooking would amount to at least one pound. With current costing three cents per kilowatt hour and meat twenty cents per pound the actual saving to the housewife in cooking the roast electrically would be as follows:

1 lb. of meat saved at 20c.....	\$.20
2 kw-hr at 3c cost.....	.06

Actual saving\$0.14

Important to Use Proper Utensils.—Only flat bottomed utensils should be used for surface cooking on the electric range. Air is a poor conductor of heat, and consequently, the closer the heating unit can be brought to the bottom of the utensil, the greater will be the efficiency of operation. The necessity is particularly apparent in ranges making use of an element of the enclosed type, where the heat is transmitted to the food from a hot surface through the bottom of a utensil. If direct metallic contact is not secured the efficiency will be tremendously impaired; slow operation will result; and the housewife will become displeased.

Agate or enameled ware should never be used on enclosed type elements. Iron, copper, or aluminum vessels will be found far more efficient. On the other hand, agate, enameled ware, and black bottomed iron utensils have been found very satisfactory for use with open type elements. Polished metallic bottom surfaces reflect and do not take up the heat from a radiant type element as do black surfaces. Contrarywise, highly polished sides and tops retain heat in a utensil much more efficiently than do dark or rough surfaces. If the bottom of any kind of utensil is corrugated, hollowed out or warped it cannot be expected to give satisfactory results.

Economy in Range Operation.—Food prepared on the cooking surface will not burn on the inside of the utensil as long as any moisture remains in the vessel, because heat is applied only at the bottom and never at the sides. For this reason, the amount of water usually required to keep food from burning may be reduced and the operations performed more easily and quickly. The food will be steamed thoroughly, and the natural sweetness and flavor will be cooked into the food, rather than boiled out into the water poured away. Water absorbs more heat than any commonly known substance, and a little economy in the use of water will effect considerable saving in both heat and electricity.

Users of electric ranges should be encouraged to use water drawn from the hot water storage supply for cooking purposes. Water taken from the top of a tank is obviously purer than that taken from the water mains because the tank acts as a natural settling basin for the collection of all impurities and sediment. If hot water is used in preparing foods, the operations may be done more quickly, and considerable saving in current consumption effected.

One very common method of effecting economies in the operation of a range, is to place as many foods as possible in the oven instead of on the cooking sur-

face. The oven, being heavily insulated, retains practically all the heat generated and the usual losses that attend cooking on the surface units are thereby done away with.

Water for laundry work, washing, bathing, and other domestic purposes cannot be heated as economically on an electric range surface as by other means. If the housewife desires, however, she may successfully boil clothes by placing an ordinary copper bot-



Hughes Junior Range (for Early Training of Housewife).

tom boiler over two of the range discs. Quicker action will result if the boiler is kept covered, and a heavy paper wrapped about the sides of the vessel.

The saving that may be effected by skilful use of the individual three-heat switches is often little understood by the average woman. She should be trained to know that the low heat consumes but one-quarter, and the medium heat one-half as much current, as the high heat. Food brought to the boiling point on high heat should be retained at this temperature at low or medium heat. A boiling temperature higher than 212 degrees F. cannot be obtained in an open vessel and food will cook just as quickly when boiling slowly as when boiling rapidly.

THE NATIONAL ELECTRICAL SAFETY CODE.

The National Electrical Safety Code of the Bureau of Standards in its second edition comprises, under the first three parts, a proposed national standard for safe construction and installation of electrical supply equipment in stations, of electrical transmission, distribution, and signal lines, and of the electrical utilization equipment of factories, offices and homes. It also includes as part four a set of safety rules to be observed in work upon electrical equipment and lines. The rules have been submitted to much careful study, to discussion at many conferences, and to wide criticism through correspondence, since the first edition published April 29, 1915, and which was marked "Preliminary Edition—Submitted for Discussion and Criticism—Not for Adoption."

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Eighty-four oil tankers are under construction in American shipyards. The total gross tonnage of these ships is over a half million.

* * *

Dangers to transportation through European waters and the Suez canal during 1915 resulted in turning to California a half million dollars of the American trade with British India.

* * *

One of the commendable accomplishments of the recent convention of the National Safety Council at Detroit was the adoption of a universal danger symbol—a red ball on a white Maltese cross with a black background.

* * *

The United States for the first time in her history ranked first in exports from and imports into Chile during 1915, receiving more than forty-two per cent of Chilean exports and selling to Chile more than thirty-three per cent of the goods imported.

* * *

Even the gas bus has appeared as a jitney. In England a jitney bus is being operated over a twelve mile run by having installed above its passenger compartment a huge rubber-lined gas bag that contains four hundred fifty feet of gas for operating purposes.

* * *

The operation of a plan so minute in its detail as to cover the individual visitation of every one of the nineteen thousand Jovians in America within a month is now in full swing. The resulting enthusiasm and renewed interest engendered will be watched by all well-wishers of the order.

* * *

Fear of the Sherman anti-trust act is a valid reason for breaking a contract, according to a decision recently by the United States Circuit Court of Appeals at San Francisco, Cal., in the case of the Davenport Independent Telephone Company of Washington against the Pacific Telephone & Telegraph Company.

* * *

The one-man car which found its initial installation in Missoula, Montana, some years back, still continues to find a useful and economic field of application. The Tacoma Railway & Power Company of Tacoma, Wash., is rebuilding six double end, single truck closed cars and equipping them for one-man operation.

* * *

The latest effort leading to scientific efficiency has just been inaugurated by the University of California which offers to send to any community of the state upon request, a woman field agent to show how farm work may be made easier and pleasanter by new labor saving methods. In these methods electrical appliances play the leading role.

The possibility of producing pig iron in New Zealand on a large scale is being thoroughly studied by the authorities as well as by private interests here. It is proposed to use electricity for this purpose instead of coal, as indicated in a circular containing the report of the chief electrical engineer of the New Zealand government.

* * *

Within the past few weeks the season of daylight saving, wherever it has been tried, has come to an end, and the clocks have gone back to their normal standing. As to whether the psychologic effect of fooling oneself into believing that an hour movement ahead in a time piece is sufficient in itself to energize the human makeup to fuller effort is still a debatable question.

* * *

When Goodyear, the inventor of rubber, showed the world how a little sulphur would help vulcanize the gumming mass of pure para, he little thought of the thousand and one applications his discovery would have. From the simple desire to provide the oilskins in use by the mariners of merry Old England with a covering that would not dry out or crack, has grown an industry that enters nearly every phase of modern life, among the extremes of which may be mentioned the office packet rubber and the automobile tire.

* * *

Nitrate deposits in many parts of the United States have been examined during the last two years by the United States Geological Survey, Department of the Interior. The importance of finding a natural supply of nitrates within our own borders, which might serve our needs in case of war, has given incentive to this work and has directed widespread public attention to the subject. According to the press bulletin of the Department of the Interior the investigation has proved disappointing. Once again the gaze turns toward hydroelectric development for manufacture of nitrates.

* * *

The Virginia Railway & Power Company has taken steps to provide an absolute safety stop at railway grade crossings. Should the motorman in approaching the grade crossing not heed the proper signals to bring his car to a stop, so that the crossing may be properly flagged, the spring contact on top of the car engages an inverted channel, which is energized, thereby energizing the magnet of an electro-pneumatic valve. This valve sands the track, cuts off the current and brings the car to an emergency stop. It is then necessary for the conductor or motorman to alight from the car and reset the valve before the car can proceed as he cannot restore the power to the car or release his brakes until this is done.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Hitherto engineers of the eight Pacific Coast states have prided themselves upon the fact that while the population of this section of our country is but six per cent of the total, yet within its confines are to be found more than one-third of

Forward

the hydroelectric power developed in the United States. This investment in central station construction and equipment, exclusive of combined electric railway and power companies, represents an outlay of over six hundred million dollars.

With the new year in sight the outlook for the future is most encouraging. A sense of confidence and expectancy is felt by all. Never before in the history of the West have her financial institutions been on a more solid footing, her agricultural production more sought for in the open markets of the world or her mines and other natural resources been developed and operated to such a maximum of effort.

With this inward feeling of security and confidence for the future has come a desire on the part of Western engineers to come in closer contact with their brother engineers in the countries bordering the Pacific. For years the golden traditions of California and the West have thrilled those who dwell in our neighboring countries of the Pacific and the doings and happening of each have closely been allied to the thought and progress of the other.

It is with an idea of cementing these golden ties which bind the countries bordering the Pacific and with a profound feeling of confidence in the business outlook for the immediate future, that the Journal of Electricity with the new year proposes to take a very ambitious move forward.

Beginning with the first day of January the Journal will be published thereafter on the first and fifteenth of each month as a semi-monthly. This new arrangement will allow its publishers to greatly diversify the editorial composition and vastly extend its present field of usefulness. A further detailed account of the new Journal and its ideals will be found on one of the advertising pages of this issue, where we have taken this means of advising our readers of the most important announcement we have yet made.

The new Journal will endeavor to enter not only the places of business for engineering and construction, but also the associated commercial houses of all our neighboring countries of the Pacific. Plans are now under way to forward this object, announcement of which will be made at a later date.

As an instance of the growing commercial relationship with our Pacific Coast neighbors the case of the Republic of Chile to the south may be cited. In 1915 the United States for the first time in its history ranked first both in exports from and imports into Chile, receiving more than forty-two per cent of the goods imported. Machinery, machine tools, instruments, apparatus, industrial oils and fuel largely make up the imports of the United States into Chile.

But while commerce and engineering must largely be the material means of interchange with our neighbors, it is to be the purpose of the new Journal to interest itself vitally in the ethical standard of this interchange and in assisting in the standardization of engineering and commercial methods and mediums of exchange. It shall be its purpose to give to these countries ideas of engineering growth and expansion that represent the very best and truest of our Western ethics, but free from those factors that have in the past had a tendency to mar her wholesome growth. On the other hand the Journal hopes to bring to its present readers much of the newness of life and wholesomeness of business enterprise and activity that pervade our Pacific Coast neighbors.

The Journal feels that in this new move it has back of it the strong support and good wishes of all its readers, and with the fullest assurance and confidence of their continued support takes this forward move.

An unusual method of educating the housewife in labor-saving devices has been inaugurated during the past year by the agricultural extension division of a Western state university.

Taking the Appliance into the House

In California any group of neighbor women, any woman's club, or any community desiring a demonstration on how to make the farm household work easier and pleasanter by new labor-saving methods need only write to the state university and with no charge whatever a woman demonstrator is sent to fill the request.

The fundamental idea is to increase the scientific efficiency of the home and especially to show how the farm home may be made more livable and attractive and how the family may get more real enjoyment from life.

A map recently compiled by the university authorities showing where such women's farm home demonstrations have been held during the past year and one-half records one hundred and forty different demonstrations in twenty-eight California counties before more than seven thousand women.

It is needless to remark in passing that an ever increasing proportion of the labor saving devices exhibited are electrically operated.

It would seem that this method of demonstration is superior to any other. After all is said and done, the success or failure of an electric appliance or in fact of any other type of household labor saving device must eventually rise or fall upon the merits of each individual case. The actual trying out in the home is hence the final and crucial test.

The slow entrance of electrical labor saving appliances into the home is in most cases directly traceable to the fact that sufficient actual demonstration in the home is lacking. Often times the trial that is made is so biased in its setting that it lacks the conviction of the onlookers to create a desire to purchase and install in the home.

It would seem an excellent idea for those interested in the sale of electrical appliances to see to it that an ever increasing proportion of labor saving electrical appliances were at the service of Western uni-

versities and colleges in order that the rural communities may be properly educated and new fields for appliance sales thereby opened.

The ever widening applications of electrical energy in driving the wheels of industry and pushing forward the bounds of commerce

Splendid Outlook in Coast Shipbuilding were never more marked on the Pacific Coast than at this writing.

For some time back engineers of the West have noted with growing satisfaction the splendid future for shipbuilding on the Pacific Coast. Today this industry has advanced to such proportions that the new work now under way in the various shipyards of this section of the country represent a very large percentage of the building at present undertaken in all the yards of the nation.

There are several factors that are accountable for this state of affairs, and among them is to be reckoned as by no means the least the fact that ingenuity and building methods are here to be found that not only favorably compare with that of other districts, but in several notable instances are proving to be superior.

Take, for instance, the recently completed oil tanker La Brea, a description of which is to be found on another page of this issue. Here the steam turbine drive and the electrically operated pump have distinctly won out in the operation of this boat in comparison with a sister ship operating under the triple-expansion steam drive formerly advocated as the more efficient.

By referring to the data compiled in this article it is seen that the turbine driven tanker was in port 36.4 per cent less time and discharged 55.4 per cent more oil per hour than its sister ship, which is operated under the triple-expansion, reciprocating steam drive. Indeed, in a recent trip to one of the ports of Chile, the latter boat preceded the former by two days and yet notwithstanding the fact that the turbine driven boat had been out of dock a month longer than the reciprocating engine drive and a greater time in warm water, it is stated that it could have discharged its cargo first had not the contrary been previously arranged.

The electrical operation of the oil pumps that control the loading and unloading features of the fleet of tankers to which the La Brea belongs is also a factor of considerable interest to engineers of the West.

Undoubtedly it will prove from time to time of great economic importance to operate these pumps by electrical energy purchased from local hydroelectric companies when these boats are in port where electrical energy may be contracted for. Thus this new development in tanker design is of great economic value to the central stations of the Coast.

Again, in countless other ways electrical applications and appliances are winning their way into modern shipbuilding design. Indeed, so much so that it may well be anticipated that the continued prosperity of the shipbuilding industry is of tremendous importance to the electrical activities of the Coast, and every means should be taken to further link the destinies of the one with the other.

PERSONALS

W. E. Hayes, of the Hayes & Van Fleet Electric Company of Santa Rosa, was a recent visitor at San Francisco.

Earl P. Durley, of the Rieber Laboratories has recently been appointed managing engineer of that company.

M. L. Joslyn, president of the Joslyn Supply Company of Chicago, has returned East after a short trip to Seattle.

Frank Somers, manager of the Century Electric Company of San Jose, spent a few days in San Francisco this week.

S. V. Walton, commercial manager Pacific Gas & Electric Company, has returned to San Francisco from a trip to Los Angeles.

L. F. Youdall, manager of the Electric Machinery & Equipment Company of Stockton, was at San Francisco during the past week.

G. W. Bernhard, district manager of the Great Western Power Company of Petaluma, was a recent business visitor at San Francisco.

C. F. Haller, of the Haller-Cunningham Company, has recently left for Chester, Pa., to install a wireless set on the steamship "Malmanger."

F. J. Airey, Los Angeles district manager of the Pacific States Electric Company, spent a few days on business at San Francisco this week.

C. V. Schneider, manager of the Electrical Supply Company of Sacramento, was a business visitor at San Francisco the first part of the week.

Wm. Crow, sales manager of the Rector System Gas Heating Company at San Francisco, has left for an extended trip throughout the Northwest.

C. B. Hall, treasurer and secretary of the Illinois Electric Company, will return to Los Angeles this week from the Westinghouse jobbers agents' meeting at Hot Springs, Va.

Wynn Meredith, of the firm of Sanderson & Porter, who has been superintending operations on the pipe lines being built in Oklahoma, will arrive at San Francisco December 20th.

H. S. Perkins, local manager of the J. H. Parker Company of Parkersburg, West Virginia, recently returned from an extended business trip throughout the East, where he visited his factory.

C. G. A. Baker, vice-president and treasurer of the Baker-Joslyn Company, returned to San Francisco the first of the week after a few weeks' business trip through Seattle and the Northwest.

Fred Myrtle, publicity manager for the Pacific Gas & Electric Company, formally threw the switch which tied in the new No. 4 hydroelectric plant with the rest of the system on November 25th.

W. C. Cole, of the Westinghouse Electric & Manufacturing Company, spent a few days at Marysville last week, and was present at the launching of the Yuba Construction Company's new dredge No. 16.

F. W. Gay, who recently opened offices as consulting engineer in the Alaska Commercial Building, San Francisco, has been appointed engineer by the Bankers Trust Company, holders of the underlying mortgage of the Mt. Whitney Power & Electric Company.

H. J. Verfurth, general manager of the Central California Electric Company at Lindsay, has left for an extended Eastern trip, where he will attend the meeting of the Willard Storage Battery Company at Toledo, Ohio, and make a tour of inspection of the manufacturing centers of the East.

L. S. Webber, formerly with the Turner Company of San Francisco, and **J. B. Kimber**, who were on the joint committee of telephone and power companies, to study the inductive

interference set up by the high tension wire, have recently joined the engineering force of the Rieber Laboratory.

John W. Beckman, chemical engineer, has recently returned from the Second Annual National Exposition of Chemical Industries held in New York City under the auspices of the American Electro-Chemical Society. Mr. Beckman was the guest of the Oakland Kilowatt Klub on November 23d and gave an interesting address concerning Pacific Electro-chemical possibilities.

Harris J. Ryan and **J. C. Clark**, of the electrical engineering faculty of Stanford University, proved themselves admirable hosts in the entertainment of the San Francisco A. I. E. E. Section which visited the Stanford University High Tension Laboratories on Saturday afternoon, November 25th. Interesting experiments were performed on insulators subjected to high voltage and high frequency strains, and instructive explanation was given covering the phenomena observed during the tests.

MEETING NOTICES.

San Francisco Section Institute of Radio Engineers.

A meeting on the evening of November 21st, was held at the Engineers' Club, San Francisco, by the local members of the Institute of Radio Engineers, for the purpose of organizing a local branch of the institute. The meeting was called to order by acting chairman W. W. Hanscom, after which V. Ford Greaves, radio engineer with the U. S. Department of Commerce, gave a short talk on the organization of the new branch and the benefit offered to the members by attending the meetings. Election of officers for the ensuing year followed, W. W. Hanscom being unanimously elected chairman, V. Ford Greaves, secretary-treasurer, and H. G. Aylsworth being elected the remaining member of the executive committee. George S. de Sousa, traffic manager of the Marconi Wireless Telegraph Company, read a copy of the new radio bill which has been drafted by the navy department to be presented before the next session of Congress. After discussion it appeared that the bill was not favored by the majority present and that it is not the right step to be taken towards the development and restrictions of radio work at the present time.

Los Angeles Jovian Electric League.

Edw. Woodbury of the Pacific Light & Power Corporation, was chairman of the day at the regular weekly luncheon on November 22d. H. L. Carnahan, commissioner of corporations of the state of California, was the guest of honor, and in an instructive and entertaining informal talk, told of the activities of the corporation department in the work of protecting the public through the law which requires all corporations, except public utilities, to obtain a permit from the department before treasury stock can be issued. He asserted that legitimate business is solidly behind the law, which went into operation January 2, 1915 and that through its operation, the prices of corporate securities have been raised, and also that a noticeable increase in savings accounts has occurred, and moreover, has reduced the number of enterprises of questionable character over 90 per cent. In closing he stated that the department is glad to assist and inform the public on all matters within its scope, i.e., that of building up legitimate business. Tribune Sessions announced the rejuvenation to be held at the Elks' Club, on December 8th, and through his efforts a large class of candidates has been secured.

Portland A. I. E. E. AND N. E. L. A. Meetings.

The joint local sections of the A. I. E. E. and N. E. L. A. had a special meeting in the main hall of the central library at Portland, Oregon, Thursday evening, November 23d.

Dr. Earl V. Morrow, recently from the staff of the Belgian hospital, gave an extremely interesting lecture on "Experiences in Belgium." His talk was illustrated with a num-

ber of lantern slides, taken by himself and with the consent of King Albert of Belgium.

Dr. Morrow had charge of the American Red Cross unit sent to Belgium, consisting of ten doctors and sixty nurses. His hospital was close to the first line trenches and handled only surgical cases. It contained 2200 beds. He told of the terrible sanitary conditions of the trenches, which were beyond description as the stench from the unburied dead, mud and rats combined to make this condition. He classed the various methods of destruction in the following manner as regards the one which causes the greatest destruction. Automatic guns, first, curtain fire next 42 centimeter guns of the Germans, and aeroplane bombs and darts last.

San Francisco Electrical Development and Jovian League.

That the November 22d luncheon was the best attended of the present administration may be regarded as a tribute to Fred H. Leggett, chairman of the day, and N. J. Prendergast, chairman of the entertainment committee, who has recently been providing many high class features for the League meetings. The guests and speakers of the day were three distinguished Japanese gentlemen, Hon. Massanco Hanibara Consul General of Japan, Mr. K. K. Kawakami and J. G. Kasai, who gave an instructive address on Trade Relations Between Japan and the United States. Mr. Leggett, in introducing the speakers, said that "trade means contact, contact dispels misunderstanding, misunderstanding dispels disputes." Mr. Kasai traced the growth in trade between the United States since Commodore Perry's visit six years ago. He gave statistics as to the trade of today. Raw silk constitutes 85 per cent of the total imports from Japan. The chief exports from this country to Japan are cotton, kerosene and steel plates. The speaker refuted various jingo charges of discrimination, favoritism and menace. He briefly reviewed the present state of the electrical industry in Japan and made an earnest plea for strong commercial relations between the two countries. At the suggestion of President L. H. Newbert the guests and speakers were given a rising vote of thanks.

The Oregon Society of Engineers.

The Oregon Society of Engineers had their regular monthly meeting at the Rose City Club House, East 57th street and Sandy boulevard, Portland, Oregon, Thursday evening, November 23d. Capt. George S. Edmonstone gave a talk on the O. W. R. R. & N. regrade project. His talk was illustrated by lantern slides. The O. W. R. R. & N. regrade will cost about \$600,000 and will consist of the lowering of the tracks of the railroad company from East 32d to East 92d street; building seven bridges over them, and constructing the proper approaches and other necessary works. J. C. Stevens, second vice-president of the society, was chairman of the evening. The attendance was fifty.

The regular bi-monthly meeting of the luncheon club of the local sections of the A. I. E. E. and the N. E. L. A. and the Oregon Society of Engineers was held in the orange room of the Oregon hotel at 12:15 p. m. November 22d..

Mr. O. B. Coldwell, general superintendent of the Portland Railway, Light & Power Company, acted as chairman of the day. Mr. W. P. Hawley, Jr., of the Hawley Pulp & Paper Company, of Oregon City, was to have spoken on the "Application of Electricity in the Paper Industry," but on account of business was detained in Oregon City and could not attend.

Mr. E. F. Whitney of the General Electric Company, spoke in his place on the same subject. Mr. Whitney outlined the various interesting and unique points in regard to the adaptation of electricity to the special machines used in the manufacture of paper, such as the grinders, gordon machines, beaters and paper machines. Two prizes were given away, an electric toaster and a flashlight. The meeting was under the auspices of the Portland R., L. & P. Co. The attendance was seventy-two.

San Francisco Section A. I. E. E.

The regular monthly meeting was held at the Engineers' Club, November 24th, Chairman J. E. Woodbridge, presiding. The general subject was "Deterioration of Suspension Type Insulators," with an introductory paper by J. E. Woodbridge and J. P. Jollyman, a paper on methods of experiment by Professor J. C. Clark and a paper on ceramics by Professor Harris J. Ryan.

Mr. Woodbridge explained that the necessity for learning the causes of the failure of high tension insulators had induced several California power companies to subscribe to a fund for an exhaustive series of tests in the high tension laboratory at Stanford University during the summer of 1916. These tests demonstrated the fact that the trouble is due primarily to the porosity of the porcelain but as yet have suggested no satisfactory means for alleviating the difficulty. All porcelain was found to be more or less porous due to the fact that it cannot be liquefied in the process of manufacture. The experiments would seem to indicate that the most satisfactory substitute would be fused silica, which has high dielectric and mechanical strength.

Professor Clark described the apparatus employed to detect defective units with greater celerity and certainty than is obtainable with an ordinary megger. This apparatus consists essentially of an initial source of 25,000 volt current, transformers, kenetron, condenser, and galvanometer, together with guard rings to eliminate errors due to leakage. Several hundred units from six makers were tested. These tests showed that strain does not affect insulating properties, that with increased temperature there is a rapid decrease of resistance and that the presence of moisture lessens resistance. Many futile attempts were made to obtain a standard method of regulating the moisture content. A rough classification of insulators as slightly porous, porous and very porous is possible, but no satisfaction was obtained in coordinating insulation properties with moisture content.

Professor Ryan discussed the ceramics of the problem as regards durability, electrical strength, refractoriness, mechanical strength, design and cost. All these requirements are closely interrelated and porcelain is satisfactory in every respect except durability. He believes that there is too great a difference between acceptance tests and service tests. In his studies he has called into consultation the geologist, chemist, physicist and ceramist. The geologist advises that high durability is not to be expected in porous bodies. Dry process porcelain is consequently not serviceable because in the process of manufacture a porosity of 1 per cent is attainable with difficulty, whereas 1-10 per cent or less can be reached with wet process porcelain. Waterlogged porous porcelain becomes an electrolytic conductor in effect. Likewise the use of cement for attaching pins will eventually cause insulator trouble.

Professor Ryan presented a number of diagrams and abstracts from the transactions of the American Ceramic Society. These showed that the best electrical porcelain is obtained with a firing temperature of about 1355 degrees C. Overfired porcelain is brittle and mechanically unreliable while the underfired is porous. The porosity cannot be corrected by annealing or form of design. Porcelain with a high percentage of flint is less porous and this suggests that fused quartz would be suitable for insulators except for the difficulty in making it free from gas bubbles.

In the ensuing discussion J. A. Koontz stated that a slightly porous insulator may not become waterlogged for a number of years and thus give good service, but that it will eventually deteriorate with time. W. W. Hanscom suggested that the microscope should be useful in testing insulators, that porosity might be used by impregnation and that some liquid other than water might be better adapted to test purposes.



NEWS NOTES



INCORPORATIONS.

BOZEMAN, MONT.—The Gallatin Valley Gas Company, capitalized at \$300,000, has filed articles of incorporation and has asked this place for a franchise.

YUMA, ARIZ.—Articles of incorporation have been filed by the Yuma Light, Gas & Water Company. The incorporators are: R. M. Moore, D. F. Hill and Frank V. Pfaffinger, all of Los Angeles, Cal. Capital is \$200,000.

ILLUMINATION.

WILLCOX, ARIZ.—Before long the town will be lighted with electric lights.

OAKLAND, CAL.—City Engineer Goodwin is fixing the location of the new electroliers to be erected on East Fourteenth street.

CHICO, CAL.—The board of trustees has instructed City Engineer Martin Polk to draw plans and specifications for an electrolier system.

ROSEBURG, ORE.—The Miller Hill Electric Company of Portland has been awarded the electrical contract on Roseburg's \$90,000 high school.

FRESNO, CAL.—The contract for the installation of an electrolier lighting system has been let to the Mt. Whitney Power & Electric Company for \$2900.

MERCED, CAL.—Co-operation of the board of supervisors in the city scheme of installing an electrolier system has been assured by the county board.

LOS ANGELES, CAL.—Sealed bids will be received by the board of public service commissioners before December 8th for incandescent street lighting equipment, in accordance with specifications on file with the board.

MYRTLE CREEK, ORE.—Bids will be received by the town recorder, Chas. W. Rice, until December 5th, for the construction of a water and light plant, according to proposition No. 1 of the plans and specifications on file with the recorder.

ANAHEIM, CAL.—At a recent meeting of the board of trustees, W. A. Mattox, representing the Western Gas Engine Company, addressed the board in reference to furnishing the city with light. The board has taken the matter under consideration.

CARPENTERIA, CAL.—A committee of the chamber of commerce on electric lights is bringing the matter of street lighting to a focus as rapidly as possible and it is hoped that steps towards calling a special election may be taken before the first of the year.

SANTA BARBARA, CAL.—At an early date action will be taken toward creating a lighting district on State street and adopting plans and specifications. There will be 14 lights to the block between De la Guerra and Victoria and 10 in the block on the boulevard.

POMONA, CAL.—It is reported that another whole section of the city lying between Alvarado and Horizon and San Antonio and Garey avenues, has been practically signed up for ornamental lights and the matter may soon be brought before the city council.

RENO NEVADA.—The Gardnerville & Douglas County Milling & Power Company, which operates a large mill and lighting system at this place, will be enabled to make important extensions to its lighting system as soon as it completes its large storage dam.

BOISE, IDAHO.—The Shelley Light & Power Company has asked the public utilities for a certificate of convenience and necessity which would permit it to furnish the village of Shelley with electricity under the terms of a new franchise. The request has been granted by the commission.

HOLBROOK, ARIZ.—Sealed bids will be received until December 9th at the office of the chairman of trustees of Holbrook School District No. 3, for furnishing material and installing electric light wiring in Holbrook public school building now under construction.

SEATTLE, WASH.—A further step in the development of the light and power system of the city was made when an order was introduced by Councilman Erickson, providing for the construction of a steam electric power plant, adjoining the site of the present power plant on Lake Union, to cost about \$390,000.

ROUNDUP, MONTANA.—Work on two additional ornamental lighting systems in Roundup has begun. One ornamental lighting system will be an extension of that now in operation in the business district, and the other will cover the entire west side residence section of the city. The latter will be of the one-light type, with steel posts set six to the block.

TRANSMISSION.

OREGON CITY, ORE.—Fire in the new power plant of the Hawley Pulp & Paper Company's mill damaged the new generator to the extent of \$6000.

SAN FRANCISCO, CAL.—The Great Western Company has recently completed its high tension steel pole line between Valona and Vallejo, total distance of 14 miles, using 75 ft. steel poles.

MOGOLLON, N. M.—A representative of the state engineer's office has visited this place securing data and inspecting the proposed hydroelectric sites. This move augurs well for the early realization of adequate and cheaper power for the district.

OAKLAND, CAL.—The Key Route Station, known as the Yerba Buena Station of Oakland, has recently been converted from the old reciprocating type engine to a modern turbine type with a 7000 kw. load, by the Great Western Power Company.

YREKA, CAL.—The California-Oregon Power Company made a contract with the Fruit Growers' Supply Company at Hilt to furnish power for their mills. Preparatory to constructing the line from Hornbrook to Hilt, a survey is being made between these two towns.

RITZVILLE, WASH.—The Pacific Light & Power Company has made application to the board of county commissioners asking for a franchise to construct transmission lines for the purpose of conveying electricity over the roads of Adams County. A hearing will be held December 5.

SALT LAKE CITY, UTAH.—Extensive development of the Utah Power & Light Company, which already have taken place, and plans for future general development, have resulted in the increase of the capitalization of the company from \$45,000,000 to \$60,000,000, which was recently announced. It is reported that development will consist chiefly in extensions in furnishing power to railroads and electric furnaces of iron smelters.

SAN FRANCISCO, CAL.—Paul B. McKee, assistant to the president, accompanied by J. C. Thompson, assistant to the secretary, of the California-Oregon Power Company, have returned to San Francisco from a trip over the entire system. They state that construction is being started on a 7½ mile line from Hornbrook to Hilt, in Siskiyou County. They are using a ¾ in. common galvanized guy cable for their line on account of the high cost of copper. The company is now in new offices at 129 Leidesdorff street.

BOISE, IDAHO.—Senator Dow Dunning of Owyhee County and John C. Rice, judge-elect to the state supreme

court, appeared before the state land board and asked for a contract between the state of Idaho and the Gem Irrigation District for \$300,000. The contract would be taken before the legislature this winter and an effort made to get an appropriation for that amount with which to build a power plant at the Arrowrock dam for the purpose of furnishing the Gem district with electricity. The matter will be taken up again.

CHLORIDE, ARIZ.—The Desert Power & Water Company, after spending \$50,000 to bring its line into Chloride is confronted with the possibility of having to uproot every improvement it makes in the confines of the camp. There is no alley or street that give assurance of being where it is now located after the townsite is surveyed and plotted. The sum of \$4000 is being spent by the company in extending wire throughout the camp, and it is possible that all this will have to be done over in the near future.

TELEPHONE AND TELEGRAPH.

EVERETT, WASH.—A franchise for the construction of telephone lines in this vicinity has been granted to the People's Telephone Company.

BOISE, IDAHO.—The Arcadia Farmers' Telephone Company has been granted a certificate for the building of a telephone system to connect the community of Arcadia with the Mountain States line near Jerome.

SAND POINT, IDAHO.—Work will be commenced this week on the construction of 16 miles of government telephone line which will connect Moyie and Leonia. The line is being built under the supervision of J. A. Fitzwater.

REPUBLIC, WASH.—A plan is under way to incorporate a telephone line from Orient connecting points at Pierre Lake, Hungry Hill and Kelly Hill. The Pacific Telephone & Telegraph Company is abandoning its line between here and Bossburg.

OKANOGAN, WASH.—The commissioners have received application for a franchise from the Colville National Forest to construct telephone lines on roads leading to Chesaw, Molson, Oroville, Tonasket, Riverside, Havillah, Wauconda, Anaes, Angling and Leese.

LOS ANGELES, CAL.—At the suggestion of the city engineer the commission authorized agreements with the telephone companies for the joint use of their poles and went on record as opposed to any telephone merger unless the new company agrees to plan for the joint use of poles by the city and the company.

WILLCOX, ARIZ.—Parties representing the Mountain States Telephone Company have been here for several days looking over the property recently acquired by the company formerly the New State Telephone & Telegraph Company. They state that considerable improvements are under consideration, including replacing the present wiring with copper wires, new poles, etc.

LOS ANGELES, CAL.—Hearing on the petition of the Home Telephone Company and the Southern California Telephone Company for permission to transfer the Home franchise to the merger corporation was set up a week by the public utilities committee in order that the matter may be acted upon with as little delay as possible, and with a consequent saving to the city in the franchise fees collected from the merger corporation, and also for the purpose of saving the public the difference in rates, amounting to \$483,000 a year.

TRANSPORTATION.

CALDWELL, IDAHO.—An ordinance has been passed by the city council granting to the Boise Valley Traction Company an electric railway franchise along Cleveland boulevard, the company to construct a single track railway. An ordinance has also been passed granting to the Caldwell Traction Company a franchise to construct an electric railway along Cleveland boulevard and others.

ALBERTON, MONT.—The Chicago, Milwaukee & St. Paul Railway has added 110 miles to its electrically operated lines in Montana. This is the third unit to be changed from steam to electric operation, and extends from Deer Lodge to Alberton. Construction work on the fourth and last unit, from Alberton to Avery, Idaho, will be completed about the first of the year, at which time the railroad will have 440 miles of electric line in operation.

SALT LAKE CITY, UTAH.—Engineers of the Denver & Rio Grande Railway have completed surveys and estimates for the Soldier Summit grades, and plans will be submitted to H. U. Mudge, president of the railroad, who will make recommendations to the board of directors concerning the change from steam to electrical operation from the grades over the Wasatch Mountains. The building of a high-tension line by the Utah Power & Light Company from Provo to Price is said to be the first step in the proposed electrification. It is understood that the cost of power is now being estimated by the Utah Company and that contracts may be tentatively entered into within the next few weeks.

IRRIGATION.

VALE, ORE.—The full amount of \$150,000 in bonds of the Warm Springs Irrigation District will be offered for sale in December.

NORTH YAKIMA, WASH.—Selah-Moxee Canal Company has started work tearing out old wooden flume which will be replaced by a flume of Armco iron, the contract for which went to A. B. Fosseen & Co. at \$42,000, 12,600 ft.

UPLANDS, CAL.—Indications are that a storm water ditch to carry water from 24th street, east of Euclid and 19th street, will soon be completed, the contract having been drawn and all interested parties having agreed on various details.

GREAT FALLS, MONT.—Work upon the erection of concrete construction of the Greenfields division of the Sun River reclamation project, which was suspended last July, when the contractors of the West Coast Construction Company and Hans Pederson, gave up the work, will be resumed at once, by the sureties upon the original contractor's bonds.

STOCKTON, CAL.—Land owners in the West Side Irrigation District voted in favor of the \$295,000 bond issue to furnish funds for the construction of the district's canals, pipe lines and pumping station. The bonds will bear interest at 6 per cent and will be payable in 40 years. No time will be lost in starting the work. The district is about 8 miles long.

TERRA BELLA, CAL.—The board of directors of the Terra Bella Irrigation District have awarded \$600,000 first issue bonds to the Contractors' Securities Company of Los Angeles, at 97c on the dollar, the issue bringing \$570,000. Immediately after the awarding of the bonds the board awarded the contract for the first unit of the irrigation system to W. A. Kraner of San Francisco, at the stipulated figure of \$376,619.

DIXON, CAL.—Promoters of irrigation for the Dixon district have decided to embrace about 25,000 acres in the project instead of 55,000 as first planned, believing they can obtain sufficient signatures for this quantity. Over 2000 acres have already been signed. It is the intention to develop either the Devil's Head or Geunoc reservoir sites, the former, of which, with its distributing system, would cost about \$650,000, according to estimate, making the ultimate cost about \$26 an acre.

PLACERVILLE, CAL.—While the Railroad Commission has taken no action on the application of the Western States Gas & Electric Company to purchase the Big Ditch water system from the Baring interests, the power company has already done considerable improvement work on the property. The improvements are all in this vicinity and are being made under the supervision of William Albright. One of the most noticeable improvements is the replacing of 520 ft. of wooden 24 in. pipe on Texas Hill pipeline.

ALPHABETICAL INDEX TO ADVERTISERS

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ENGINEERING OBSERVATIONS IN THE ORIENT.

BY ROBERT SIBLEY.

GENERAL PRINCIPLES OF RADIO TELEGRAPHY AND TELEPHONY.

BY WALTER HAYNES.

ADVANTAGES OF ELECTRIC COOKING.

BY E. A. WILCOX.

THE NEW SOUTHERN CALIFORNIA EDISON COMPANY.

BY D. M. REYNOLDS.

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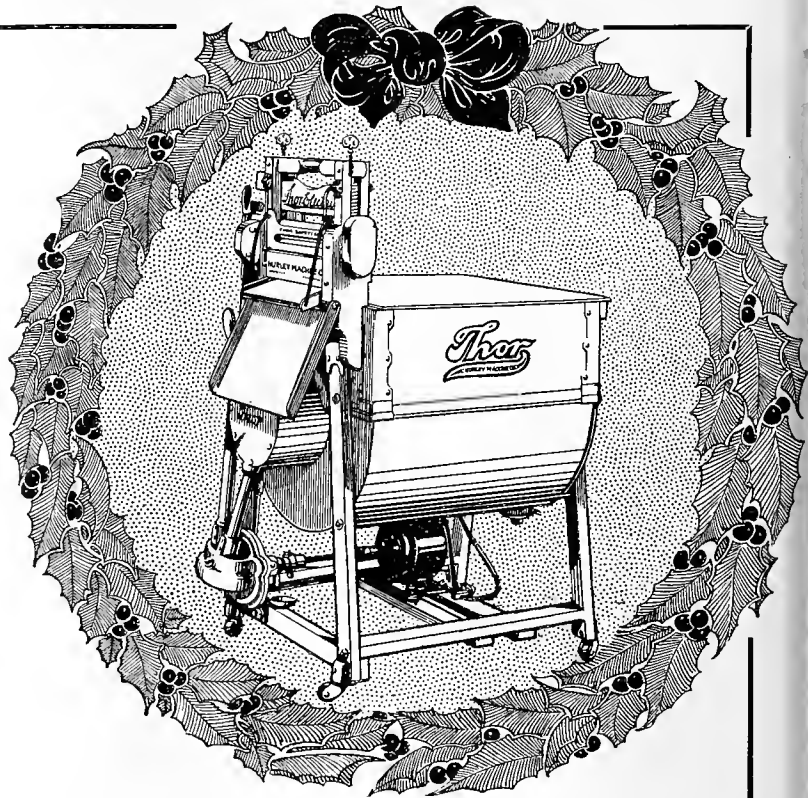
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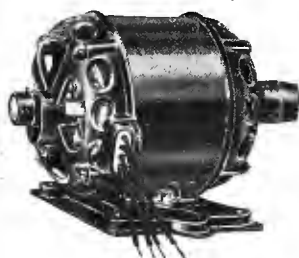
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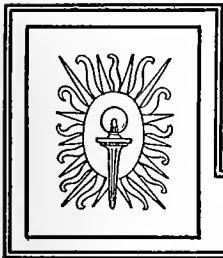
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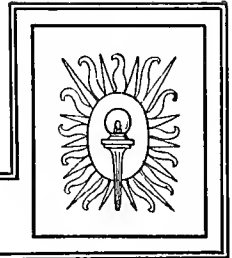
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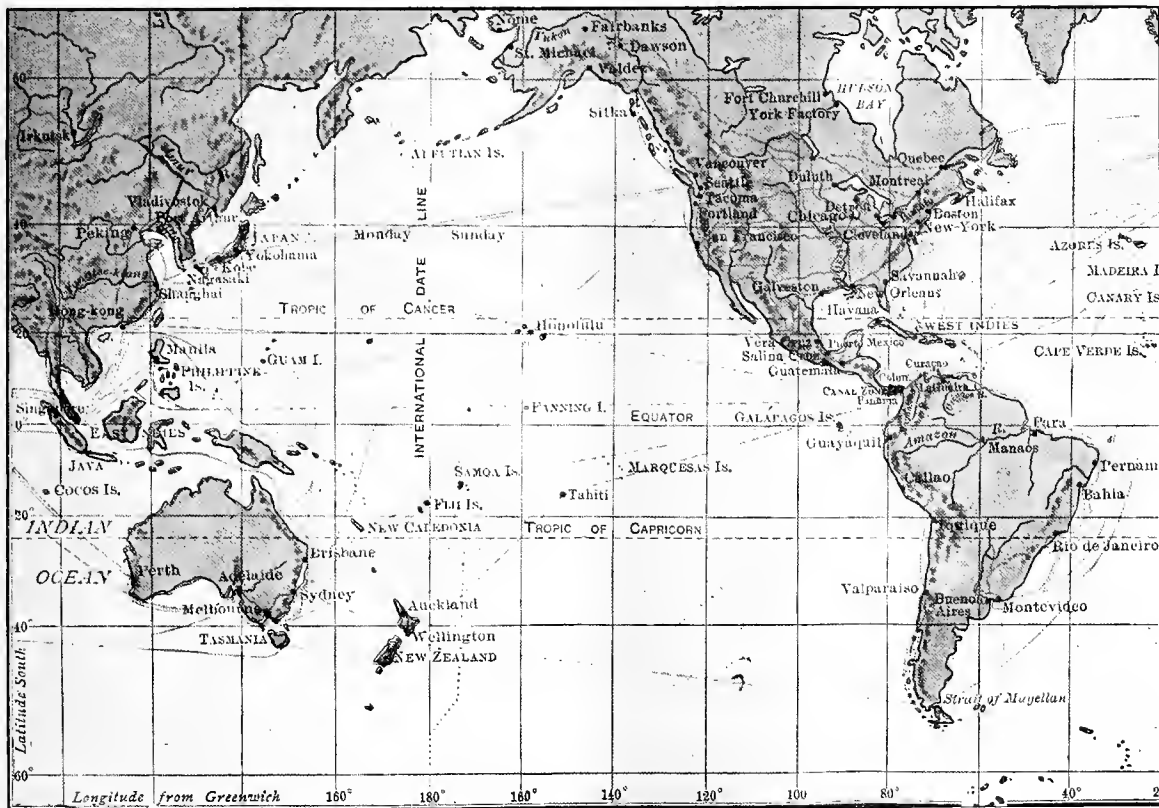
ENGINEERING OBSERVATIONS IN THE ORIENT

BY ROBERT SIBLEY.

The old adage of "Westward the course of empire takes her sway" is now once again to be borne out in fulfillment. This new commercial empire will link the countries of the Far East to those of the extreme West and claim the waters of the great Pacific as the stage upon which these countries will play a drama of friendly commercial relations so freed from domination of the one over the other and yet so intense in its promotion of international relationship

international war and the strategic position offered to citizens of the United States due to the opening of the Panama Canal present at once the near enactment of an era of opportunity for the young and aspiring probably never before offered to any nation in the world's history.

There are many fundamental truths that must be put into practical application in order that our citizens may wisely and successfully take advantage



The Field of Western Commercial and Engineering Opportunity for the Future.

and mutual understanding as to establish a new era in the contentment and prosperity of the human race.

The object of this article is to set forth the results of a personal survey of the Far East, made by the writer in the countries of the Orient with a view toward forecasting, if possible, some of the opportunities that await the American engineer in that interesting and promising section of the world.

The readjustment of the world's commercial and industrial growth due to the exigencies of the present

of these opportunities which providence has so lavishly thrust upon us. It is a sacred trust that America now has in her keeping and the wise stewardship she may show in the handling of these problems will indeed have everything to do in bringing about a permanent hold on the marked advantages over her rivals she has now gained.

The question narrows itself down to a consideration of individual effort in this great work. The technical and industrial schools of America have of late



Business Section in Modern Hong Kong.

years thrown upon the commercial world literally thousands of technically trained engineers in embryo. So long as the hammer and whir of machinery were employed in building up home industries, and the mountain fastnesses still lay untrammelled by much needed carriers of transcontinental burdens, so long were these young men able to get positions of profit and sufficient of nutriment to satisfy an appetite or craving both for physical prowess and manly aspiration.

Indeed, the past twenty-five years have been years of such stupendous effort in home development that we have scarcely dreamed of activities in foreign lands, or that there was any real duty we might owe to the undeveloped countries surrounding us on all sides. The development of a telephone system which for completeness and efficiency has no rival in other countries of the globe; the sudden development of an oil supply which now yields nearly half the world's output; the harnessing of waterpowers, now the wonder and admiration of all comers—have indeed thrust upon us the rather deadening conclusion that here in America, our own native land, our engineers for countless ages to come may well plan to limit the scope of their endeavors.

But now we see forced upon our consciousness the fallacy of this dream. The very energy with which our work has been prosecuted is making itself felt. Indeed the labor-saving efficiency methods apply equally well to the saving of the number of heads employed as well as to the number of physical bodies for

the accomplishment of engineering construction and achievement.

So fast has constructive effort gone forward in this country during the past twenty-five years that one is led to believe that the need for engineering effort in annual construction for the future will be far less than the large bodies of young men annually presenting themselves to engage in carrying forward this great work.

This was clearly the state of affairs before the opening of the present devastating international war. Engineers of real analytical minds had for months seen this inevitable result. The technical schools had begun to feel it in decreased enrollment. Indeed it has become the subject of comment editorially in some of our leading technical journals.

Those of the engineering fraternity who truly possessed the creative or "pioneering" instinct, however, could look beneath the problems and see deeper. They could see that real engineering effort, like the onward rush of civilization, might well be said to follow the adage in the opening sentence of this article; for as soon as the industrial prowess of a nation was established, the water powers reasonably exploited and harnessed, the railways constructed in sufficient economic relationship, then the horizon of the engineer of the future would in a measure be limited in that nation. While formerly his imagination could freely play in gigantic new construction, now he must make more efficient that which is already created. Although such work offers an interesting and promising field of activity, still the numbers that may be employed are comparatively limited, for one master mind, fully aware of the mistakes and accomplishments of the pioneer, can in this latter instance co-ordinate and synchronize engineering ideas of maintenance and operation that may have taken a hundred to evolve in the unfoldment of engineering knowledge.

Then, too, the concentration in engineering endeavor caused by the formation of a few large centralized engineering organizations in America has had a very marked effect in reducing the number of independent engineers who are able to successfully earn a livelihood in their profession, and as a consequence, this, too, is a contributing reason for the overflow, or rather stagnation, in the engineering technical outlook at present.



The Residence District of Canton, the Great Metropolis of Southern China—Backward in Appearance Today, but Teeming in Opportunities for the Morrow.



The Wheelbarrow and the Donkey Await Displacement in Central China for More Modern Means of Transportation.

And so it was that even before the glowing foreign opportunities unearthed by the present international death grapple, many far-sighted engineers could plainly see that a foreign outlet to engineering effort was the only solution.

This was especially true among engineers of the Pacific Coast. In order to gain laboratory or first-hand knowledge upon which to base their conclusions, many went on tours of inspection in foreign lands. South America and the Orient seemed to be the two Meccas toward which their eyes were turned.

Those who returned from South America, especially from Southern Brazil, the Argentine Republic, or Chile, seemed especially optimistic in their views for future fields of profitable endeavor.

Although the population of the Orient and South America represent extremes, still the general question of development of natural resources is practically the same in each. As a consequence, the general deductions herein set forth as applying to the Orient may be made to apply for general guidance in South America.

The first and foremost consideration one should entertain in seeking a possible livelihood abroad is one of healthful climate. The writer did not meet a single person who had lived in the tropics that would admit himself to be in better or even as good physical trim as when in the United States. Many had become physical wrecks. Hence, as a rule, unless particularly alluring or exceptional inducements are offered, keep out of the tropics.

In the Hawaiian Islands, though the climate and life of the people are delightful, due to the limited



The Gorges of the Yangtse River—Prolific in Future Power Possibilities.

scope of endeavor, the opportunities offered in engineering are practically nil.

In Japan one finds a nation of intense nervous activity. Industrial development is the thing sought for and though money is scarce, their dreams are bound to be realized, for everyone works and yearns so much for its fruition.

In Japan some American engineers have in the past been able to attain success and independence. This has, however, been the exception. Where foreign effort has entered this territory, it has largely been the English or the German engineer that has carried away the prize. This has been entirely due, not to the lack of ability of the American engineer, but to his indifference to foreign occupation.

My observations lead me to believe that in the future very little opportunity will be offered in Japan for the foreign engineer. The Japanese, more than any community or people in the world, believe in themselves, and in their own ability to solve their industrial problems. They are anxious and impatient



The Rickshaw and Camel—Typical Methods of Transportation in Japan and Mongolia.

to master foreign ideas of invention and improvement, but when mastered they then feel their independence. While the past fifty years have largely been years of imitation of others' methods, the rumination and thorough mastication of these ideas are bound to produce creative results in the next fifty years.

And so it is that Japan today is narrowing down foreign engineering effort, since their own citizens are strong enough to stand at the helm. And in its broadest aspects they can not be blamed for such a national policy.

Even one step further is now being taken in this policy of internal development in the engineering enterprise of Japan. Formerly their own students who crossed the seas to study technical methods in foreign schools and colleges, returned to instantly be awarded positions of trust and skill in their native land. Today, however, the situation is different. I talked with several college classmates of mine—all Japanese—when I was in Tokyo and discussed with them this very point. These young men themselves attained positions of trust and engineering skill in their own country, but they pointed out to me that such positions as they held came through American influence and not through any influence of their own countrymen.

To come down to plain statement, even the Japanese foreign technical graduate is discriminated against, and the graduate of the University of Tokyo or other native institution, given the preference, other things being equal. Upon closer analysis I could see in this discrimination not any particular governmental effort, but the growth in Japan of a spirit similar to our American college spirit—that same spirit which leads us all on many occasions to secure a position for a technical graduate of our own particular university in preference to the application of a man from another institution.

Hence, I found that in the case of my former Japanese classmates, they had been able to secure profitable positions because of their knowledge of American engineering methods. Interests representing the Westinghouse Electric & Manufacturing Company, the Western Electric Company, or any other concern where their knowledge of American methods and experience would be of value, always secured them positions, but, in any instance, where these became valueless or of small weight, the overwhelming influence of the universities of Tokyo, Kyoto, and others mitigated against them very seriously.

Hence it is that I say that the opportunities for the American engineer in Japan and her colonies are not very promising.

In the Philippine Islands many opportunities may offer themselves in the future, when a more stable and settled condition of governmental policy is agreed upon. The American engineers who went down there a decade ago, however, are alert and wideawake, and thus have already occupied the field for possible expansion. Indeed, I found from conversation with many of them that really their staying in Manila and the Philippine Islands was to be near by and ready when the great development of China should commence.

And, indeed, well they might be holding in future hope a participation in this great work, for China to-

day presents possibilities so vast and so great that an outlet may here well be found for our American engineers. At the same time there is absolutely no excuse for the overcrowding or crowding away of engineers of other nationalities who may rightfully cast for their share in this great work.

Of all the nations and countries of Asia and her nearby islands, China presents the most promising and gladsome possibilities for human life, although today in countless instances a living comes hard to her active population and to countless thousands life seems an unbearable burden. This situation or rather condition of outlook on life, is too well reflected in the applications quickly received by a convicted pirate who offers money for any one who will suffer his life to be taken instead of the one condemned to death. The punishment for piracy is the death sentence in China. However, the convicted pirate may legally advertise for a substitute and for the paltry payment of fifty dollars to the family of the volunteer, the culprit often escapes punishment due to the sacrifice of an innocent life.

It is well known to history that when the so-called civilized world was young China was a great nation of culture and education, with peace and plenty for her happy population. Centuries of egotism resulting from her seeming prowess, led her to adopt a course of seclusion or absolute drawing away from the rest of the world. The resulting inbreeding and stagnation thus brought upon her body politic are too well engraven upon her citizens today. When, however, the red flame of national ambition and modern ideas of culture and education permeate her vast domain, an awakening will undoubtedly result so vast and on-sweeping that it is questionable if the world has ever before witnessed such an event.

The provinces of China are rich agriculturally. Northern China would under modern methods be made to yield a large percentage of the world's output of wheat, yet today scarcely any of this important cereal is there produced. Her natural resources abound in coal, oil, and precious minerals. Her gigantic rivers teem with possibilities of power development. Her people are by nature possessed with a ceaseless activity and yet today her population presents a pitiable spectacle of graveyard worship and misdirected effort.

The main problem then is one largely for the engineer with creative or constructive imagination. It is a problem in which the poorest American technical graduate may reasonably aspire to assist in solving, for the problem is not one of wealth demanded for its solution. Ideas are what is needed—real pulsating, life throbbing ideas!

How then may the young, enthusiastic, brilliant—though poor—engineering aspirant hope to have a part in this great work? It is probably true that if a young American technical graduate packed his blankets and set out for China without any previously arranged connections, he would starve to death.

In the old days of municipal and agricultural growth along the Pacific slope of the United States, a young aspiring and truly creative engineer could set out for some live western center and reasonably hope for success. Often times during his apprentice days

he could find sufficient land survey work, patent specification drawing work, tracing and blue printing in a thrifty growing western town to allow him to grow up with the town. Most all of our prominent western engineers have thus gotten their start.

But in China things are different. The main thing necessary for success is that the young engineer associate himself with some of the larger American enterprises now being undertaken in China and thus get an opportunity to see the interior and coast possibilities, and at such times dream dreams of real constructive effort. Many young Americans are today making a splendid commercial success by having gotten just such a start.

One young man while engaged in an entirely different line of work in China noticed that the rikisha and Sedan chairmen had to yell their voices hoarse in the narrow crowded thoroughfares of the Orient. He sent home for a huge quantity of cheap but effective press bells, with the result that a handsome profit was the immediate return. This is but an instance of what any thoughtful business man can accomplish. Japan and China are world famous for their number of citizens engaged in the fishing industry. Not a one of their thousands upon thousands of boats use paint upon their weather exposed surfaces. Think of the opening for some energetic salesman who would successfully educate these men in the saving characteristics of preservative paints!

The Chinese are poor—extremely poor. The first great work then must be accomplished by the utilization of foreign capital. Today the British American Tobacco Company and the Standard Oil Company are doing the greatest business of American enterprise in China. Many promising and ambitious young men of America have enlisted their services with such companies as these, because they are thereby enabled to see much of the Chinese people and to study their characteristics. Undoubtedly the big moneyed interests of America are destined to play a huge part in the immediate development of China's natural resources. Already a horde of young American engineers are in China employed by great American corporations in gathering information and prospect data concerning China's immense resources.

On the morrow many of these young men will be come leading factors in directing the future activities of these corporations in China. Still many of them will be so alert and wide awake to possibilities surrounding them, that as time goes on they will undertake engineering endeavor for themselves. It is surprising to see how a new and untried field of endeavor awakens the creative imagination of a young aspiring American in a foreign country.

Many amusing incidents are told how the young American engineer is thinking out ways of accomplishing great things for the native and for his home company.

In conclusion, then, it is to be borne in mind that the opportunities for engineering endeavor in the Orient consist in developing the great natural resources, the harnessing of water powers, the control of flood waters, the introduction of modern efficiency methods in labor and machinery, and in countless other enterprises that would go toward assisting a population of gigantic proportions to better itself in life

which population has not in itself the wherewithal to finance such enterprises. In this great work American engineers are destined to play the leading role.

KEEPING IN STEP WITH THE WORLD'S PROGRESS.

BY J. H. MOSELY.

What are you doing to keep yourself posted on events which are happening in this country and other parts of the world?

What are you doing to keep yourself posted on the methods other business men are employing to make them successful?

Conditions which govern business all over the world are changing more rapidly today than perhaps at any other time within the last century. Now is truly a time of opportunity for the man who can look ahead.

There are few of us who do, and none of us who should, consider the day's work done when we have performed those tasks prescribed by the company. Each one of us owes it to ourself and to our country to keep in touch with the march of progress. Many of us are doing this in a sort of a fashion, but how many of us are doing anything in this line systematically?

We learn things by seeing them, by hearing them, or by reading them. A great part of our knowledge is gained by the latter method. The ordinary person can read 100 words per minute. On this basis, 15 minutes spent in reading means a total of over 500,000 words for a year. If this amount of reading is systematically done, it means an extensive knowledge which serves to put one just so much ahead of the other fellow when it comes to competition in life.

How much outside reading towards the betterment of yourself do you really do? Turn the spot light on the last two months and analyze just what you have done in this respect. At the same time think of the time that you have probably wasted during this period, and figure out for yourself just where you stand.

For a person in our line of business systematic reading of the weekly electrical trade papers is an excellent course. Such reading keeps one in touch with the latest developments in the electrical line, and also keeps one in touch with the newer methods of operating, accounting, getting business and handling customers. Practically all of our offices receive a number of the electrical publications every week. Our managers will be glad to extend the use of these copies to any employe who is not able to subscribe for himself.

In addition to the reading which one should do in order to keep in touch with his own business, every person should do a certain amount of outside reading; that is, select one or two high class magazines and read these thoroughly every week or month as they are published. In this way and in no other can one keep up with current events and problems and make himself fit for the job ahead.

Every man longs for success. In order to be successful one must do things better than the other fellow, and just as soon as a person learns to do this he will be singled out from among the crowd, and rewarded accordingly.—Texas Utility News.

GENERAL PRINCIPLES OF RADIO TELEGRAPHY AND TELEPHONY.

By WALTER HAYNES.

(In this excellent paper the author first establishes the theory upon which radio phenomena take place and then shows from the general mathematical equations involved just how one branch of modern radio telegraphy known as the air gap system has been built up. In a later paper will be described the second general class of transmitters which employ the undamped ether waves, while in the paper following will be discussed the general principles of radio telephony. These papers as a whole were recently delivered before a joint meeting of the A. I. E. E. and N. E. L. A. sections in Portland.—The Editor.)

The propagation of a wave in any elastic circumambient medium requires that some motion must take place within it. The minimum magnitude and velocity of the motion depends upon the particular medium employed, as well as its pressure and temperature.

If a kingdom of snails could be imagined endowed with ability to carry on physical research, and living under the ordinary atmospheric conditions, except that no wind should blow, it would indeed be a remarkable achievement if they should ever discover the phenomenon of air resistance since for all such velocities as they would be familiar with, the air resistance would be almost infinitesimal, and a concrete study of such prodigious velocities as 50 or 75 ft. per second could scarcely be hoped for.

Similarly, respecting ourselves, we have our being in an endless ocean of ether and for ages man has moved about within it without realizing its resistance to his movements. Nor is it to be wondered at when it is observed that a velocity of 72,000,000 miles per hour would be required to evidence a resistance equivalent to an increase of one per cent in physical inertia. The discovery of a means for disturbing the state of ether remained, therefore, until such time as scientists should devise some way of producing uncommonly high velocities. This is practically accomplished by exciting inter-atomic and molecular motions, giving rise to shorter, luminous radiation and longer, non-luminous or heat radiation respectively, or by the rapid translation of a charge of electricity from a given region and back again, which may produce non-luminous radiation of a vastly greater wave length.

These longer wave radiations have been found capable of traversing considerable distances and yet not be too dissipated for convenient detection and identification. They, therefore, have been utilized for transmitting signals, and as such constitute the sinews of the arts of radio telegraphy and radio telephony.

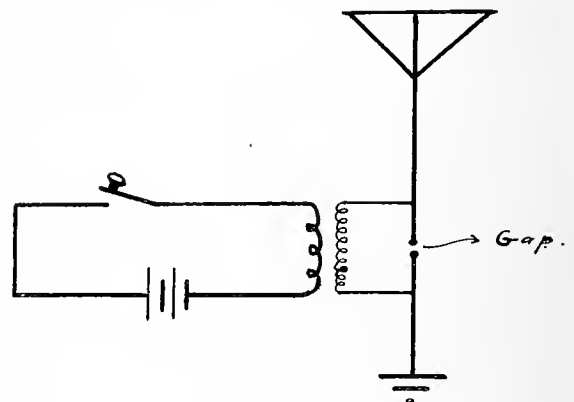
For the sake of establishing a common benchmark, a brief statement of the ultimate nature of electricity will be given.

The atoms of all elements are now believed to consist of small unit negative charges called electrons. An electrically neutral or uncharged state of a body is a state in which the atoms of a substance have a normal number or arrangement of its electrons (for the particular element in question) while the addition of electrons gives a so-called negative charge, and the subtraction of electrons gives a so-called positive charge. Electrons have the power to migrate across the inter-atomic distances at velocities of from

10,000 to 90,000 miles per second depending upon the inductance of the path. The number of electrons per second passing a given section of a circuit is a function of the current flowing; thus, according to Prof. Durrand, a current of one ampere equals 8.79×10^{18} electrons per second.

At this rate of displacement the average velocity of a given electron along a path is very slow, say 10 to 30 ft. per minute, so great is the number to be displaced in ordinary conducting materials.

To disturb a medium requires, first a force, and second its application to some movable substance or thing which shall be able to couple or grip its medium. In radio work these conditions are found in electromotive forces and electrons. The simplest oscillator is at once an alternating source of e.m.f. with conductors leading an equal distance in opposite directions from it. Since a given e.m.f. will crowd a certain number of electrons into a given electrostatic capacity, a larger group of electrons may be made to oscillate in the conductors above if an extra capacity be connected at the outside ends of the conductors. In early commercial work, these conductors and capacities were replaced by a vertical conductor connected through a gap to the earth and a more or less extensive overhead net-work of wires respectively as shown in diagram. An induction coil was used to produce the high charging e.m.f.



General Arrangement of Air Gap System of Radio Telegraphy.

The function of the air gap was to isolate the antenna until it had sufficient charge to break down the intervening air and thus close the oscillatory circuit with a virtually resistanceless electric arc. The gap would automatically open, after the energy of the charge had been dissipated and remain so until the antenna became recharged, etc.

All electrical circuits possess inductance by virtue of which, when connected in series with a capacity by a conductor whose ohmic resistance, R is not greater than

$$2 \sqrt{\frac{L}{C}}$$

(where L is measured in henries and C in farads) they sustain electrical oscillations for a greater or less time if the capacity be given an initial charge, Q , and the impressed e.m.f., immediately withdrawn.

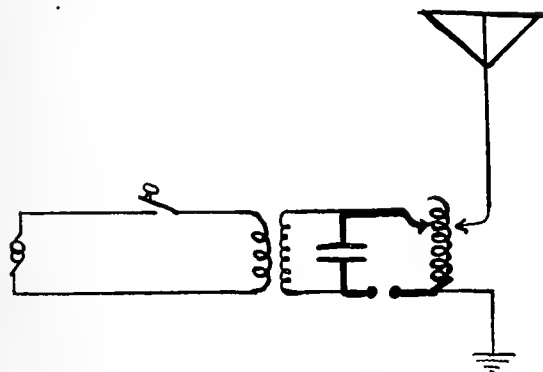
The solution of the differential equation representing this case shows that the instantaneous value of the current is:

$$i = -e^{-\frac{Rt}{2L}} \cdot \frac{EC}{LC\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}} \sin\left(t\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}\right)$$

This equation plainly shows that the current is oscillatory in character and lightly or heavily damped, according as R is small or large respectively; the limiting case being a sign wave of frequency.

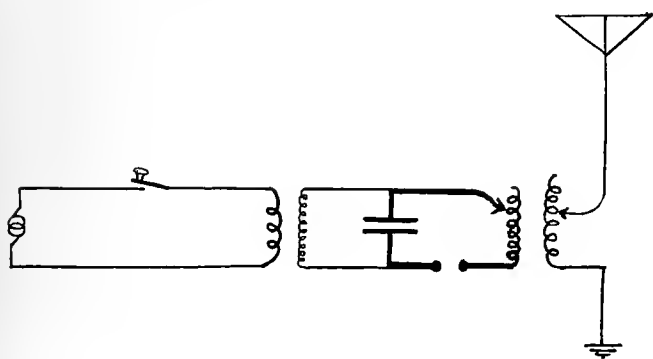
$$\frac{1}{2\pi\sqrt{LC}} \quad \text{when } R \text{ is zero.}$$

It will be observed that the period between successive charges of like sign is the reciprocal of this expression and that the length of the radiated ether wave will be the velocity of light divided by it.



Arrangement of Apparatus for Application of Large Powers and Large Capacities in Wireless Telegraphy.

So long as induction coils were used as a charging source, the arrangement as shown in the figure did fairly well, but the application of larger powers required a larger capacity and the conductive or "direct-coupled" connection was developed as shown in second diagram. This connection introduces a closed primary oscillating circuit, as shown in heavy lines, and renders the use of larger powers quite convenient. One serious drawback, however, is inherent in "tight couplings."



Connections for Limiting Radio Stations to a Single Wave Length.

A solution of the differential equations for the current in two coupled circuits, made on the assumption that the resistance is negligibly small, shows that two wave lengths, λ_1 and λ_2 , arise corresponding to the frequencies of the two harmonic components of

the resulting current. Where the tuned wave lengths of the closed and open circuits are λ_1 and λ_2 respectively, and the coefficient of coupling between the circuits is T ,

$$\lambda_1 = \sqrt{\frac{\lambda_1^2 + \lambda_2^2 + 1/(\lambda_1^2 - \lambda_2^2)^2 + 4T^2\lambda_1^2\lambda_2^2}{2}}$$

$$\lambda_2 = \sqrt{\frac{\lambda_1^2 + \lambda_2^2 - 1/(\lambda_1^2 - \lambda_2^2)^2 + 4T^2\lambda_1^2\lambda_2^2}{2}}$$

These equations show at once that a small value of T is essential to radiating the maximum of energy in a single wave length, or anything like a single wave length. In order to prevent radio stations from using two wave lengths national laws have been enacted which, in effect, prescribe a very loose coupling. The general type of circuit which complies with this requirement is shown in figure.

All these sets belong to a general class of transmitters known as "spark sets." It is important to notice that even though the primary key be held closed, the antenna radiates only a small fraction of the time, since it requires a many times greater period for the transformer to charge the closed circuit condenser than for the open circuit to radiate all the energy delivered to it in a given charge. Another characteristic feature of spark sets is that the successive amplitudes of the current waves decrease logarithmically as is evident from an inspection of its equations as given above.

ASSISTANCE GIVEN BY BUREAU OF STANDARDS.

Among the numerous conferences that have been held by representatives of manufacturing interests with the United States Bureau of Standards in the past few weeks were several in which the problems considered were of general interest.

The chemists of two large companies discussed with the bureau certain features of the recovery of potash in the burning of Portland cement.

An expert of the Forest Products Laboratory at Madison, Wis., conferred with reference to work on paper and writing materials.

A representative of a lumber concern interested in the possibility of cutting gumwood into chips at the sawmill and selling the baled chips called at the bureau.

Two technical men from Chicago conferred regarding pycnometers and calorimetric standards.

A visitor from a Japanese university was interested in paper and textile fibers.

Another visitor was acting for a company which makes scientific instruments and drafting supplies. He was especially interested in the manufacture and testing of blue-print drawing papers.

Assistance is being given to a company which contemplates the manufacture of porcelain buttons.

ADVANTAGES OF ELECTRIC COOKING.

BY E. A. WILCOX.

Elimination of Kitchen Chimneys.—If fuel is burned in a kitchen a chimney is naturally required. On the other hand the expense of installing a chimney may be obviated by using an electric range. Even with gas the harmful products of combustion must be removed as shown by the following from page 20, Technical Paper 109, U. S. Bureau of Mines:

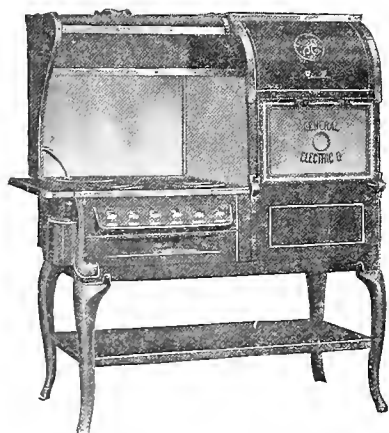
"Natural gas, when burned with sufficient oxygen for complete combustion, forms carbon dioxide and water vapor. Each cubic foot of natural gas burned produces a little over 1 cubic foot of carbon dioxide and a little more than 2 cubic feet of water vapor. Carbon dioxide is an irrespirable gas and should not be allowed to accumulate in a room. Water vapor also should be removed, because it has a depressing effect if present in still, warm air in sufficient proportion and tends to make the walls, ceilings, curtains and other objects in a room dirty because the dust is entrained by it and settles on the objects."

"The only way to remove these two gases is by means of a vent leading from the stove to the house chimney. It is absurd for any manufacturer of stoves to claim that these two gases are practically absorbed or eliminated in any other way."

Operation by Servants.—Care should be exercised in placing a range in the hands of a professional cook. This type of individual is frequently a difficult person to handle. He seldom favors anything new. He is prone to form intense prejudices; and will often refuse to make an intelligent investigation of new apparatus, especially when he has not been previously consulted. He is always a very powerful factor in matters concerning the management of a kitchen, and his position should not be overlooked.

If he dislikes equipment placed in his charge he may damage it, refuse to handle it properly, or cause the operating cost to run up excessively. Disastrous results are certain to accrue if the cook's attitude is unfavorable.

Repeated experience has proved that the housewife who does her own cooking is the most desirable user of an electric range. She will be, as a rule, thoroughly alive to its advantages, will practice the many little economies that are possible, and will generally become a "booster" for electric cooking.



General Electric No. S-3 Range.

Attention to Range Users.—When ranges are first installed the users should receive very careful atten-

tion. It must be remembered that the manipulation of an electric range is entirely new to the average housewife. If something about the apparatus is out of order; if the best results are not secured at the start; or if some of the many little economies that may be practiced are overlooked and the first month's bill proves higher than has been anticipated, an erroneous mental impression may be formed that may prove difficult to correct. If troubles are not rectified or explained away, they will become magnified as time passes, and the housewife may finally become seriously prejudiced. Furthermore, every electric range placed is naturally watched by the many friends, relatives and neighbors of the user. In as much as it is generally conceded that the best advertising medium is the satisfied customer, it is well worth while to give the user early and painstaking attention.

Electric Cooking in Schools.—The encouragement of electric cooking in the domestic departments of educational institutions will foster the more rapid introduction of electric ranges in the homes. In order that correct impressions may be created in the minds of the students, it is highly important that the equipment be intelligently selected, that the apparatus be properly installed, and that the service be the best attainable.



Domestic Science Classroom, Westminster College, Salt Lake City.

For classroom work, small rather than large individual disc stoves should be installed, because only a small amount of food need be prepared at one time. Double boilers and frying pans should be provided with each stove, and these utensils should be of a size to fit and of a kind that will operate properly with the particular type of disc stove that is installed. Small individual bake ovens are comparatively inexpensive, occupy little space, produce excellent results, and may be recommended for well-equipped departments.

In some school where domestic science is taught complete electric cooking equipments have been provided and meals prepared and served cafeteria style during the noon hour periods. The income from the nominal charge made for these meals has been adequate, in a number of instances, to pay the operating cost of the electric kitchen, as well as of the entire department.

Other institutions have gone further, and arranged for the use of electric flat irons, water heaters, and other labor-saving devices. At least one complete electric range should be made the part of any modern domestic science room equipment. The comparatively few hours during which classes are in session make

the operating cost of electrically operated installations very small. Although the income from this class of business is not large, the load is of an off-peak character, and the results are far-reaching. The favorable



McDonald Apartments, Boston, Equipped with Hughes Ranges.

impression created by equipping domestic science departments in this manner cannot but have a beneficial effect upon the school and a credit to the individuals in charge.

Electric Cooking in Apartment Houses.

Adaptability of Electric Range.—The electric range seems to be peculiarly adapted for use in apartment houses. The character of construction of the buildings, the mode of living of the tenants, and the many recognized advantages of the electric range make it much superior to the fuel burning stove. A resume of the most essential qualifications of this type of apparatus and the better conditions that may be brought about where it is installed for apartment house cooking service should not be out of place in these pages.

Economy in Space.—In the design of the modern apartment house every foot of space is valuable and the architect must plan to utilize it to the best advantage. His efforts in this direction seem to have resulted in the laying out of very small kitchens which are often stuffy and poorly ventilated. The electric



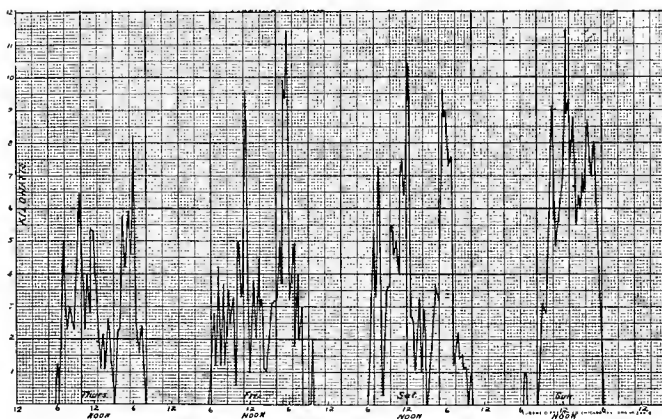
Jensen Apartments, Great Falls, Mont. (Equipped with Simplex Ranges.)

range is best fitted to meet these recognized conditions for several reasons: It is compact in construction, and as the exterior never becomes hot enough to burn the woodwork it may be placed against the wall and thereby take up less space. The unbearable heat of a fuel range in a small kitchen is eliminated. There is no combustion in the electric range and it neither throws

off poisonous fumes nor takes up the life-giving oxygen from the air.

Expense Saved.—The initial outlay required for the installation of chimneys and gas plumbing may be entirely eliminated. When the building is once occupied the periodical expenditures incident to repainting, retinting and repapering, may be cut in half. The very nature of the electric range, which creates no products of combustion, and which overcomes the smoke, moisture and grease nuisances peculiar to the fuel range, makes the frequent refinishing of interiors unnecessary.

Elimination of Hazard.—Where fuel stoves are used there is constant danger of fire. Gas offers the menace of asphyxiation and explosion. The careless opening of a valve, a temporary cut-off of the main supply, or a little mistake of the cook or housewife may



Typical Apartment House Cooking Load Curve, 24 Ranges, 75 kw. Connected, Maximum Demand 11½ kw.

result disastrously. In as much as the electric range produces no flame, and neither utilizes nor gives off any explosive or poisonous gas, its use does away with all danger of loss of life or property.

DELAYS IN LOADING AND UNLOADING CARS

On the question of loading and unloading of cars the following table showing the percentage of cars held overtime in Oregon as compared to California, Arizona, and New Mexico—the other states over which the Pacific Car Demurrage Bureau has jurisdiction—has been compiled from the record. The months of February, March, April and May, 1916, (during the first two of which a shortage of cars existed in Oregon) have been taken as representative.

Percentage of Cars Held Overtime.

	California. Per cent.	Arizona. Per cent.	New Mexico. Per cent.	Oregon. Per cent.
For loading.....	.64	1.39	3.36	8.67
For unloading.....	2.82	3.25	7.76	9.86
For reconsignment..	5.66	14.01	8.00	11.66
For all cars.....	1.74	3.55	4.06	8.37

It is evident from an analysis of this table that Oregon shippers, as a whole, are not entirely blameless for the acuteness of the present car shortage. On the contrary, they are open to severe censure on the manner in which cars have been handled while in their possession, and the commission cannot too strongly urge immediate action on the part of shippers to rectify this condition.

THE NEW SOUTHERN CALIFORNIA EDISON COMPANY.

BY D. M. REYNOLDS.

The Southern California Edison Company and the Pacific Light & Power Corporation have filed application with the State Railroad Commission in San Francisco for the merging of their properties—the two largest public utilities in Southern California. The Pacific Light & Power properties include practically the entire ownership of Ventura County Power Company.

The consolidated properties will operate under the name of Southern California Edison Company, which will then be the fifth in size of electric operating companies in the United States, having a value in excess of \$75,000,000, and the merger will have the effect of actually decreasing the amount of securities now outstanding.

Upon the completion of the transfer the Southern California Edison Company will have 5 steam and 13 hydro generating plants of 130,000 and 150,000 horsepower capacity, respectively, or a total capacity of nearly 300,000 horsepower, which includes the wonderful hydroelectric development at Big Creek. In addition, undeveloped hydroelectric developments capable of generating about 400,000 additional horsepower are owned. These enormous quantities of electric energy are now transmitted over 1380 miles of transmission lines to 103 substations, and carried over 3700 miles of distributing lines to supply the larger portion of Southern California, embracing 150 cities and towns and surrounding territory. Suitable additions will be made to this vast network of lines as the undeveloped hydraulic properties, now owned, are brought into use. The two companies now have a total of 165,000 consumers.

President John B. Miller of the Edison Company is quoted as saying that the consolidation of the many generating plants and distributing systems into one large property will permit of efficiencies in operation and economies heretofore impossible of accomplishment. The effect will undoubtedly be to reduce the cost of current but the greatest benefit will be through the interconnecting of the many hydroelectric and steam plants operated by these companies so as to insure absolute continuity of service.

From the investor's standpoint, the combination is highly desirable as the size of the consolidated systems, the variety of territory served and the great diversity in the location and characteristics of the consumers supplied enforces a stability to the company's business which should make its securities a very attractive investment. Its financial position will also be particularly strong.

Many times in the past ten years negotiations towards the consolidation of these properties have been taken up but only recently has an understanding been reached by which Mr. H. E. Huntington, the principal owner of the stock of the Pacific Light & Power Corporation, and Mr. Miller have been able to work out a satisfactory basis for the merger.

Under the new arrangement, Mr. Huntington, while parting with the direct ownership of the Pacific Light & Power Corporation retains his interest in

electrical affairs of Southern California by becoming the largest stockholder of the Southern California Edison Company.

This consolidation has been pending for some time and its announcement at this critical period in the negotiations between the city and the companies for the purchase by the city of Los Angeles distributing systems is taken to mean that the Edison-Pacific interests are preparing the way for the acceptance of the city's offer. By consolidating all the operation within the city under one ownership, i.e., the city of Los Angeles, and all of the business outside of the city under one ownership, i.e., Southern California Edison Company, the lines of ownership will be so distinctly drawn that it may reasonably be expected the city and the Edison Company will be able to harmonize on all matters and co-operate toward the end of building up the greatest electric system in America.

FINANCIAL STATUS OF AFFAIRS IN COLOMBIA.

The general disturbance in overseas commerce incident to the European war has had two important results in Colombia. These are a general shortening of credit and an increased commercial intimacy with the United States. Before the war the long credits allowed by European firms constituted an effective barrier to many American manufacturers who were not willing or not in a position to meet this competition. The curtailing of the European market has given American exporters the advantage and the importers have had, perforce, to accept the shorter terms. As a result they have had to shorten their credits to domestic purchasers. When Europe again enters the Colombian markets under normal conditions this system of long credits will undoubtedly prove a strong factor in competition with American trade. In the past the usual custom was to draw at 6 to 9 months' sight with interest at $\frac{1}{2}$ per cent per month. For a time in 1915 in trade with the United States 30 days' sight was the rule, and a large amount of purchases were made on terms of cash with orders or on arrival of goods, but with better acquaintance and increasing familiarity of American manufacturers with the Colombian market conditions became easier and 60, 90 and even 120 days' sight are now the general terms for credit business.

Interest rates for bank loans in 1914 were 1 per cent per month, but in 1915 these were raised to $1\frac{1}{4}$ and $1\frac{1}{2}$ per cent. The improved situation toward the end of the year was shown in a slight reduction of the interest rate. The average length of bank loans on notes is 90 days.

With a population between 5,000,000 and 6,000,000 Colombia had in circulation in 1915 \$24,500,000, divided as follows: Paper (gold value), \$10,056,300; silver (fractional), \$7,004,700; nickel, \$997,700; gold (Colombian), \$85,000; and American and English money, \$6,356,300.

The paper is guaranteed by gold deposits amounting to \$2,586,400 and by emeralds deposited in Europe valued at \$2,663,600, a total of \$5,250,000, or one-half the value of the paper in circulation.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Photographic blue-bulb lamps have made their appearance in the electric lighting system of "movie" studios.

* * *

In planning any "safety first" rules to observe for an organization it is well to remember that the best safeguard is a careful man.

* * *

For the first time in its history the exports of crude petroleum from California during one month recently exceeded two millions of dollars in value.

* * *

With copper at thirty cents it is estimated the Anaconda Copper Mining Company will show profits of seventy-five million dollars during the next year.

* * *

The National Association of Railway Commissioners has gone on record as being opposed to the exclusive federal control of interstate carriers and other utilities.

* * *

Wireless operation has entered the field of hydro-electric transmission. The Southern Sierras Power Company has arranged for radio service between its generating station and its substations in California.

* * *

Ceramic engineering, under which department research in the strength and porosity of insulators will be studied, is the title of a new clay-working industry research bureau at the University of Illinois.

* * *

The effect of glare in electric headlights both for the use of automobiles and locomotives is receiving careful consideration in many quarters of the country, for upon its proper solution depends much in the way of accident prevention.

* * *

Eighty-two thousand local telephone switches were completed within five days' time recently in an advertising campaign in San Francisco, by means of one hundred and fifty individual business lines that were specially installed for the purpose of the campaign.

* * *

During the past eight years, out of two hundred and forty million passengers carried over the lines of the Southern Pacific Company, but one person has been killed in a train accident. Such is one of the wonders that electricity properly harnessed is accomplishing in safeguarding life.

* * *

It has been shown that the brittleness of copper developed during heating in the process of manufacture and frequently ascribed to "burning," is in reality a deoxidation. This brittleness is said to be due to the reduction of the cuprous oxide around the primary copper grains, leaving a spongy mass of little mechanical

strength, and not to any direct action of the hydrogen upon the copper itself.

* * *

The Canadian government has stopped the exportation of large blocks of Canadian-Niagara power to American consumers, and never before has there been such a shortage of power in western New York as during the last thirty days. The War Department has permitted further diversions of Niagara on the American side in order to meet the emergency.

* * *

In spite of the fact that traditions in steam locomotive design lean toward low centers of gravity in order to properly overcome the stresses produced in rounding curves and swaying from side to side, an eastern designer gives it as his opinion that an electric locomotive can be designed for high speed with safety, regardless of the height of the center of gravity.

* * *

A cubic foot of sand will absorb on an average about two quarts of water and certain porous sandstones will absorb from two to six quarts. While there is no definite lower limit to the penetration of water, it is probable that little surface water penetrates more than three miles below the surface of the earth and most of the pores and crevices in rocks are closed below the depth of a few hundred feet.

* * *

With the Statue of Liberty flood lighted in New York Harbor at the touch of the President of the United States and the American flag electrically unfurled in exquisite lighting effect in San Francisco by a member of the California Railroad Commission, America's Electrical Week partook of a national tinge that shows to what depths electrical energy and its applications have sunk into the hearts and affections of the American people today.

* * *

The John Fritz medal which is awarded from time to time for notable scientific or industrial achievement provided for in a fund subscribed in memory of the great engineering pioneer, John Fritz, is this year to be awarded to Dr. Elihu Thompson. The award meets with the hearty approval of engineers generally as a proper recognition of the achievements of Dr. Thompson in electrical inventions, in electrical engineering, in industrial development, and in scientific research.

* * *

It is suggested in London Answers that one reason for the slow progress of the telephone in Russia may perhaps be due to the impossibility of such a conversation as the following: "Hello, is that you, Dvisastkivchsmartvoiczskic?" "No; it is Zollem-schouskaffirnocknstiffsgrowoff. Who's speaking?" "Seximochoczkiertjuakmxkischoffemoff. I want to know if Xliferomanskeffskillmajuwchzvastowskswiebierski is still stopping with Dvisastkivchsmartvoiczskic."

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POWER AND GAS

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The electrical industry in the United States—electric light and power plants, electric railways, telephone and telegraph—represents an investment of over ten billion dollars. The security of this investment in public utilities is largely dependent upon the goodwill of the public. As the public comes to realize the magnitude of the capital thus tied up in the public service, the small return it has received, the legislative restrictions with which it is surrounded and the strenuous efforts which have been made to perfect the service, it is hoped to create more cordial relations between the public service company and the public served.

The first friendly advances have been made by the companies. They realize the mistakes of their predecessors, they have done their best to correct them, and now by frank and open dealing they hope to regain public favor.

This is the fundamental purpose of the national observance of America's Electrical Week. While directly concerned with increasing the sale of electrical devices, this great campaign is in reality but one means of bringing realization of the growing indispensibility of electricity and consequently an understanding of the reason why the electrical companies should be treated more fairly.

According to the last census there are more than 5000 central electric light and power stations in the United States. Over two billion dollars has been invested in this branch of the electrical industry and yet the annual income is less than three per cent. The central stations employ an army of nearly one hundred thousand employees, their salaries and wages representing about one-fifth of the gross income. They develop over 7½ million horsepower, two-thirds of which is by steam and one-third by water.

These figures represent merely the power plants, being exclusive of the manufacturing and sale branches of the industry. They show what stands back of the button which the Modern Aladdin can press to summon the great genie Electricity to do his bidding.

Electricity is perhaps the one commodity which has not increased in price during the past twenty years. On the contrary, its cost to the consumer has steadily decreased. This has been made possible by higher efficiency in generation and the longer hours to which current is put to use. Instead of being used merely for lighting between six and ten in the evening, it is employed for power and heat during the day, consequently enabling the same generating capacity to do double duty at but slightly greater expense.

The tremendous advance in electrical utilization has been made possible only by the combined efforts of scientists, engineers and financiers during the past twenty years. It has involved the solution of many difficult problems, the construction of great dams in the mountains, the building of power houses with

their big generators, huge transformers and long transmission lines, and the arrangement of auxiliary steam plants to insure continuity of service.

In view of these facts the electrical industry merits the continued patronage and support of the people at large.

The new year holds in promise exceptional opportunities for the engineer of the West. Not only are development matters each day crystallizing into more active promotion, but the substantial footing upon which Western securities are now recognized to rest, encourage capital and business enterprise to assume an optimistic view of the immediate future.

The Engineer and the New West

For the past two or three years there has been growing in our midst a feeling that the activities of the engineer of the immediate future are to greatly expand. The analytical mind of the engineer is coming more and more to the front as of supreme importance not alone in those affairs of technical application, but indeed in all the affairs that affect the dollar either in investment or in commercial interchange.

In view of this fact it is not difficult to forecast that in the immediate future the Western engineer is to be called upon to assume vastly broadened responsibilities both at home and in the countries bordering the Pacific.

These countries present in themselves such boundless wealth of natural resources that it is not too much to say that this last great West in the world's history will eclipse in accomplishment all the brilliant effort of the past ages.

It would seem that at this stage of development—a stage yet in the embryo—that now is the psychological time to lay a groundwork for foreign interchange in commercial and engineering effort that will be lasting in its usefulness to the group of nations concerned.

To accomplish this there is much to be done. There must be established such a sincerity of purpose and freedom from desire of domination by all concerned as to impress each with the fact that only open-handed, square-deal methods are to be tolerated.

In the long run, no human relationship or interchange can be permanent unless such human relationship or interchange is mentally helpful to all concerned. Let any parties to the issue attempt to dominate and be the favored nation and what is the result? The European war.

It would seem, then, that now is the opportune time for the countries of the Pacific to come to mutual understanding. Differences of race and religion must sink into insignificance in comparison with the all importance of community of interest that bind them together.

The engineer can do much in forwarding this community of interest. Standardization of engineering method and units will aid vastly in cementing such bonds of relationship.

The opportunities that are in the countries of the Orient and South America today are largely ones that require vast outlay of capital. This money must be raised in the United States, and as a consequence a duty is involved which, properly executed, with full vision of justice to the American client and to the citizen of these countries, will hasten the day of close and united friendship with these countries.

Many unfortunate happenings have taken place in the upbuilding of our Western enterprises. Let the engineers of America see to it that those happenings are not repeated in the financing and exploiting of operations in the countries bordering the Pacific—the last new West.

The past week has witnessed an event that bids well to pave the way for the final adjustment of one of the bitterest hydroelectric controversies of recent years.

Los Angeles Controversy Settled

Application for approval of a merger of the Pacific Light & Power Corporation with the Southern California Edison Company is now before the State Railroad Commission. The consolidated properties will be operated under the name of the Southern California Edison Company which now becomes the fifth in size of electrically operated companies in the United States.

The building of the Los Angeles Aqueduct conceived of originally as a necessary undertaking to supply that city with its domestic water supply has been the underlying cause of the bitter controversy in power development alluded to above. This situation was brought about by the development of power due to the fall in water level from time to time incidental to the bringing of this water into Los Angeles.

The backers of this Los Angeles municipal undertaking first proposed to build their own distributing system and compete with those already in the field. Next it was proposed to wholesale the power to the companies already occupying the field. Finally after several proposals and counter proposals the California Railroad Commission was sought to fix a basis of valuation for the distributing systems of Los Angeles or at least so much of the privately owned lines as would enable the city project to properly furnish energy for lighting and power within its confines.

The controversy over the price which the city of Los Angeles should pay for the power plants of the Southern California Edison Company and the Pacific Light & Power Corporation within the city limits has been settled.

The directors of the two companies have voted unanimously to accept the offer of the city to buy at the prices fixed by the Railroad Commission. The city of Los Angeles will also pay for extensions the companies have made since the appraisal, and for re-funding securities, thus bringing the whole payment to about \$8,500,000.

With this matter wiped away the unified effort in Southern California should make for efficiency and service that will be in full keeping with the traditions of that enterprising section of the West.

PERSONALS

T. E. Burger, Los Angeles manager of the Western Electric Company, was at San Francisco this week.

Louis R. Wheeler, of the International Electric Company of Los Angeles, was at San Francisco this week.

H. W. Jacobs, of the H. W. Jacobs Company of Santa Rosa, was a recent business visitor at San Francisco.

H. C. Ross, of the Pacific Gas & Electric Company of Sacramento, spent a few days at San Francisco this week.

Wm. Hahn, of the City Electric Lighting Company of Riverside, Cal., spent a few days at San Francisco this week.

T. E. Bibbins, president of the Pacific States Electric Company, left recently for a few weeks' trip throughout the East.

C. E. Condit, who recently resigned as assistant engineer for the Northwestern Electric Company of Portland, is at Oatman, Ariz.

A. G. Wishon, general manager of the San Joaquin Light & Power Company of Fresno, was a recent business visitor at San Francisco.

H. T. Bushman, president of the Bushman Manufacturing Company of St. Louis, Mo., was a recent business visitor on the Pacific Coast.

L. E. Boyer, with the Edison Lamp Works of the General Electric Company of Schenectady, N. Y., is a recent visitor at San Francisco.

S. A. Taylor, president of the Electric Railway & Manufacturers' Supply Company, will return shortly from an extended visit to the East.

B. J. Klein, Pacific Coast manager of the Bristol Company of Waterbury, Conn., has left for a two weeks' business trip throughout the southern part of California.

H. H. Hughes, representative of the Westinghouse Electric & Manufacturing Company of Fresno, spent a few days the first part of the week at San Francisco.

A. J. Myers, Pacific Coast manager of the Wagner Electric Manufacturing Company, has recently returned from an extended trip to Los Angeles and throughout the south.

L. E. Sperry, sales agent of the New York Wire Company of San Francisco, recently left for an extended trip throughout the East, and expects to return about the 20th of December.

C. E. Heise, San Francisco district manager of the Westinghouse Electric & Manufacturing Company, who has been in the East for the past four weeks, has returned to San Francisco.

W. Brewster Hall, Pacific Coast sales manager Pass & Seymour, Inc., left San Francisco this week for Syracuse, New York. The San Francisco office has been temporarily closed, Mr. Hall expecting to make frequent trips to the Coast to care for the company's business, his headquarters being at the factory at Solvay, N. Y.

J. G. De Remer, formerly of San Francisco and later of the firm of Martin & De Remer of New York, has recently terminated his partnership and has opened offices for general consulting practice at No. 55 Liberty street, where he will continue the practice formerly handled by the firm.

E. J. Wallis, newly appointed Pacific Coast manager of the Western Electric Company, arrived at San Francisco this week from Atlanta, Georgia. **F. H. Leggett**, who leaves the Coast to go to the New York City offices of the company, was a host at a luncheon given in Mr. Wallis' honor to officials of the Pacific Telephone & Telegraph Company and the Western Electric Company.

MEETING NOTICES.

Los Angeles Jovian Electric League.

The regular weekly luncheon held on November 29th, was presided over by President Morphy, who introduced W. R. Edwards, with the Pacific States Electric Company, as chairman of the day.

Police Judge Thos. P. White gave the principal address. His subject, "Am I my Brother's Keeper?" scored the systems employed in the jails and penal institutions. He stated that the public exacts a terrible penalty of a person suspected of a crime and forces them to share quarters with all sorts of characters. He further said that the state's appropriation for any criminal sentenced to prison is \$60, but that no provision is made for the man under probation. It leaves him to go back to his old haunts and the evil associates that caused his fall. In closing, he stated that this, and every other city, should provide an industrial home for women, providing for segregation—according to their crimes, and that discriminating treatment should be accorded the men, on a farm provided for that purpose, and that all convicts should be placed at productive and remunerative work.

A musical entertainment concluded the program.

San Francisco Electrical Development and Jovian League.

The November 29th luncheon was Oakland day with Mr. J. A. Vandegrift as chairman of the day and Congressman Jos. R. Knowland as speaker. Mr. Knowland took as his subject the California Missions, the most interesting landmarks in California history. The Franciscan padres were the real pioneers, establishing their first mission in 1769. These missions were twenty-one in number, being so located that a day's foot journey would carry the traveler from one to the other. Mr. Knowland told of the efforts to preserve the nineteen whose ruins still stand. He urged their preservation from both the sentimental and commercial standpoint, also laying emphasis upon the beauty of their architecture which is being copied throughout the world. In conclusion he told of other praiseworthy purposes of the Native Sons to commemorate historic landmarks—Colton Hall at Monterey, Sutter's Fort at Sacramento, Portsmouth Square and the spot of Broderick-Terry duel, weaving a story of the romance of the associations suggested.

A special luncheon was held in the ballroom of the Palace Hotel in the midst of the electrical show on December 4th, with an attendance of 150 members and guests. C. C. Hillis as chairman of the day, introduced Mr. John Barry, a member of the Ford peace expedition. In a most telling manner Mr. Barry recited the various incidents leading up to the failure of the expedition. The first bone of contention was President Wilson's preparedness message, then at the Hague there was disagreement as to complete disarmament versus limited armament and finally at Stockholm it was found that funds were not sufficient to accomplish the desired purposes. He spoke of the impractical ideas of some of the socialist idealists and concluded with a clear cut statement of the German feeling regarding the war. In common with the other belligerents they think that they are fighting for justice and humanity. While admitting that they struck first they believe that Russia's mobilization was the first act of war. Commercial jealousy was responsible for the start of the war and pride for its prolongation. A large party in Germany desires peace, with indemnity, but without territorial acquisition. Mr. Barry stated that the original feeling of exaltation has been succeeded by a spirit that will fight to the finish. He believes that the war is not so much between the Allies and the central powers as between the jingoes and the peace advocates. It can be stopped by friendly advance from the more enlightened nations.

ENGINEERS OF THREE STATES TO FORM A SOCIETY.

A. F. Barnes, Dean of Engineering of the New Mexico College of Agriculture and Mechanic Arts, State College, N. M., has been endeavoring to organize a Southwestern Engineering Society. Letters have been received from prominent engineers in the three states of New Mexico, Arizona and Texas expressing the need of such an organization. Among the men who have promised their support are: Dean G. M. Butler, of the University of Arizona, Tucson, Arizona; Dean S. H. Worrell, of the Texas School of Mines at El Paso, Texas; Professor Brenneman, of the University of New Mexico, Albuquerque, N. M.; Mr. Samuel I. Bousman, engineer for the Chino Copper Company, Hurley, N. M.; Mr. H. L. Stevens, consulting refrigeration engineer, El Paso, Texas; Mr. E. H. Baldwin, of El Paso, Texas, project manager of the Elephant Butte Dam, and Mr. S. O. Andros, Albuquerque, N. M., "Chairman of the New Mexico State Directors, Naval Consulting Board."

The object of this organization will be to promote the science of engineering in the Southwest. The principle means for this purpose shall be: First, the holding of meetings for the reading and discussion of professional papers, especially upon such questions as are peculiar to this region; second, to give opportunity for social intercourse and thus establish a common interest in the welfare of the engineering profession.

Admission to this society will no doubt not only be open to practicing engineers, but opportunity to join will be given to any person so connected with engineering as to qualify him to co-operate with engineers in the advancement of professional knowledge.

It is planned in a short time to call a meeting of those engineers that have shown interest in the matter and at such a time draw up tentative plans and program for a general meeting to be held at a suitable place, at which time final organization can be effected.

MEN OF THE INDUSTRY.

W. C. Stevens was appointed sales manager of the Cutler-Hammer Mfg. Co., of Milwaukee, at the last District Managers' meeting held at the head office in Milwaukee. Mr. Stevens has been connected with the Cutler-Hammer Company about ten years, the last three years of which he has been in charge of the New York office. Mr. Stevens graduated from Cornell in 1906 with the degree of mechanical engineer and at once took up the shop, testing room and engineering course at the Milwaukee

factory. The latter part of 1907 he was sent to the Pittsburgh office, in which field he devoted his time to sales engineering and installation work. Much of the installation and experimental work connected with controllers for the steel plants and unloading plants was done under his supervision. These controllers were for blast furnace skip hoists, ore bridges, coal bridges, coal dumpers, car conveyors and other equipment used in the steel and iron industry. Mr. Stevens has already assumed his new duties but will not remove to Milwaukee until about the first of January. Mr. Stevens is a member of the Machinery Club of New York, the American Institute of Electrical Engineers and the Theta Delta Chi fraternity. Mr. T. D. Montgomery has been appointed to the position made vacant by the promotion of Mr. Stevens.

Mr. T. D. Montgomery has been appointed manager of the New York office of The Cutler-Hammer Mfg. Co., of Mil-

waukee to succeed Mr. W. C. Stevens who has now taken up his new duties as sales manager. Mr. Montgomery joined the Cutler-Hammer forces when the J. L. Schureman Company of Chicago, with which he was connected, was bought out eight years ago. He has been a member of the New York office sales engineering force for the past four years.

TRADE NOTES.

The Roller-Smith Company of New York has just issued Bulletin No. 201, covering a portable storage battery equipment for use with the Roller-Smith bond tester. The particular application of this apparatus is to provide an external source of current for testing rail bonds with the Roller-Smith bond tester.

The reprints of the Illuminating Engineering Lecture Course recently held at the University of Pennsylvania it is hoped will be available shortly after the first of the year. Members of the Illuminating Engineering Society may obtain copies of these reprints at a reduced price—not to exceed five dollars, provided the orders are received prior to the date of publication.

The Benjamin Electric Manufacturing Company of Chicago has mapped out a nation-wide campaign of publicity for its Benjamin 92, Tu-for-Wun 2-way plug device. This campaign will be carried out in Collier's, Saturday Evening Post and other magazines. Backed up by substantial assistance to the dealers in furnishing them a large and attractive five-color window display card and other matter, this campaign of publicity should meet the enthusiastic support of the electrical trade as a whole.

NEW BULLETINS.

"Pulling Poles in Eight Minutes" is the title of an interesting pamphlet just issued by the Electric Material Company of San Francisco, Western distributors of the "Simplex Jack."

The Cutler-Hammer Manufacturing Company of Milwaukee has just issued four descriptive leaflets on electric lamp sockets entitled "General Information," "Fixture Installation," "Lamp Cord Suspension," and "Why 660 Watts Capacity is Essential Today."

The Van Dorn & Dutton Company, of Cleveland, Ohio, has just issued a forty-page booklet entitled "Facts About Gears." The contents are divided into twenty-one sections, a perusal of which will enable even the non-technical gear user to figure out complete and accurate specifications for any system of gears. As a digest of specialized gear data the booklet is worthy of a place in every gear user's reference library. Interested persons may obtain copies from the Van Dorn & Dutton Company's general offices at Cleveland, Ohio.

BOOK REVIEW.

Flow of Water in Pipes. By George T. Prince, C. E. Size; 4 in. by 6¼ in.; 150 pp.; replete with tables and data; cloth binding. Published by D. Van Nostrand Company of New York City and for sale by the Technical Book Shop, San Francisco. Price, \$2.00.

This excellent book consists in presenting to the engineer for the first time data computed from five of the best known formulas the flow of water through pipes and tabulated the results for the ready use of the engineer for pipes varying in diameter from 4 inches to 120 inches. The data is tabulated in the following order: Fall per 1000 ft.; mean velocity in feet per sec.; discharge in cu. ft. per sec.; U. S. gallons and millions of gallons per 24 hrs.; and finally the resulting value of C.

There has been a long felt need of a book of this character and it should find wide application among hydraulic engineers.

NEWS NOTES

INCORPORATIONS.

TACOMA, WASH.—The Sound Telephone & Telegraph Company has been incorporated here.

HAILEY, IDAHO.—The Wood River Power Company has been incorporated with a capital of 2750 shares of \$100 each. The incorporators are I. E. Rockwell, L. R. W. Rockwell and E. W. Rising.

FINANCIAL.

SAN FRANCISCO, CAL.—A certificate has been issued to the Pacific Telephone & Telegraph Company to operate in California in buying and selling exchange and issuing letters of credit.

SALEM, ORE.—The annual report of the Douglas County Light & Water Company shows that the company's surplus for the year was \$11,753. The operating income totaled \$45,197. The company serves the towns of Roseburg, Sutherlin, Oakland, Drain and Yoncalla.

SAN FRANCISCO, CAL.—The Pacific Light & Power Company, through the U. S. Mortgage & Trust Company, has called for tenders to December 6 of as many of its first and refunding mortgage bonds as can be purchased for \$251,789, now available for the sinking fund.

LOS ANGELES, CAL.—Steps have been taken by the water board to place the municipal power department in a state of preparedness, in case the negotiations for the purchase of private power systems by the city does not go through. Contracts have been let for \$365,000 of copper wire, etc., and the board has called for bids for \$600,000 worth of additional wire and cable.

SAN FRANCISCO, CAL.—The statement of the San Joaquin Light & Power Company for October shows bond interest earned nearly twice during that month. For the ten months ended October 31, 1916, bond interest was earned 2.24 times. The statement as furnished to Cyrus Peirce & Co. follows:

	Oct., 1916.	Yr. to date.
Gross earnings	\$147,096.87	\$1,533,183.57
Miscellaneous income	2,662.07	18,987.65
Expenses, taxes, etc.	63,091.84	597,957.42
Net income	84,005.03	935,226.15
Bond interest	42,407.94	417,373.47
Surplus	41,597.69	517,852.68

SALT LAKE CITY, UTAH.—By a resolution adopted in Augusta, Me., the capital stock of the Utah Power & Light Company was increased from \$45,000,000 to \$60,000,000. A copy of the resolution was filed at the office of the secretary of State. The company is incorporated under the laws of the State of Maine, for which reason the voting of the resolution took place in that state. The resolution provides for the increase of the capital stock of \$45,000,000, divided into 450,000 shares of \$100 a share, to \$60,000,000 divided into 600,000 shares of a par value of \$100 a share. The 600,000 shares of the company's stock is divided into preferred stock, 150,000 shares; secondary preferred stock, 100,000 shares, and common stock 350,000 shares. The copy of the resolution as filed was attested by John E. Bunker, secretary of the state of Maine.

ILLUMINATION.

FRESNO, CAL.—Plans and specifications for an electrolier system on South J street have been adopted by the city trustees.

HAILEY, IDAHO.—The Wood River Power Company has been incorporated for \$275,000 by I. E. Rockwell, E. W. Rising, et al.

CASHMERE, WASH.—Citizens are planning a municipal power plant to furnish light, heat and power to this place and surrounding territory.

FRESNO, CAL.—A resolution of intention has been adopted for the construction of an electrolier street lighting system upon "J" street from Inyo street to Los Angeles street.

SAN FRANCISCO, CAL.—The Mission Promotion Association has under consideration plans for a new lighting system on Sixteenth street between Howard and Dolores streets.

BOZEMAN, MONT.—The Gallatin Valley Gas Company has been granted a franchise here and will begin the construction of a plant in the spring. It is capitalized at \$300,000.

LOS ANGELES, CAL.—The Board of Supervisors has let the contract for installing and furnishing current for Norwalk Lighting District to the Southern California Edison Company.

LOS ANGELES, CAL.—The board of supervisors has awarded the contract for installing lights and furnishing current for the Verdugo Lighting District to the city of Glendale.

PALO ALTO, CAL.—Until court matters connected with the proposed taking over of the local gas business are settled no vote will be taken on the \$70,000 bond issue for the project.

BUTTE, MONT.—Resolution passed the city council creating light district No. 221, providing for 62 cast iron or pressed steel posts for an electric lighting system. A. A. Dockstadter is city clerk.

MERCED, CAL.—The board of trustees has received plans and specifications for the newly established electrolier district. It has been decided to place electroliers down Court House avenue.

CHINO, CAL.—The adoption of plans and specifications for the new electrolier lighting system which are being drawn by Martin C. Polk will come up at the next meeting of the board of trustees.

MERCED, CAL.—Electric Engineer Chas. T. Phillips of San Francisco has completed plans for the ornamental lighting system to be installed in Merced and these plans have been approved by the city trustees.

INDEPENDENCE, CAL.—When bids were opened for a 50 year franchise within this county the only bid received was from the Southern Sierras Power Company, in the sum of \$100 and it was ordered accepted.

LIBBY, MONT.—An auxiliary power plant operated by a crude oil engine costing about \$10,000, and entirely separate from the present hydroelectric plant, will be installed by the Libby Water Works, Electric Light & Power Company.

SAN LEANDRO, CAL.—The question of installing electroliers in the business section, as far as the trustees are concerned, is settled. The trustees voted to install Union steel electroliers. But the property owners yet have an opportunity of protesting.

EUREKA, CAL.—An application for an electric plant, together with a petition from the taxpayers of the town of Eureka, asking a franchise over streets and alleys over which the system is to be operated, has been received from the Eureka Electric Light Company.

LIBBY, MONT.—The International Power & Construction Company has filed a condemnation suit against the Great Northern Railway Company and David R. McGinnis to make it possible to erect a dam to harness the Kootenai River at Kootenai Falls for electricity. The company, which was recently organized by Leo H. Faust and C. E. Lukens, is capitalized for \$250,000.

SEATTLE, WASH.—An ordinance was introduced into the council by Councilman Erickson providing for the construction of a steam electric power plant adjoining the site of the existing plant on Lake Union to cost approximately \$290,000. This measure is part of the plan for the purchase of a completely developed hydroelectric plant costing \$3,000,000, the condemnation of the Snoqualmie plant and local distributing system of the traction company and the extension of the municipal lighting system. The ordinance authorizes the public works board to prepare plans and also authorizes a bond issue of \$390,000.

TRANSMISSION.

CASHMERE, WASH.—Attorney A. H. Mohler reports the issuance of bonds for a proposed municipal hydroelectric power plant.

TWIN FALLS, IDAHO.—The Long Hike Company secured a site on the river near Jarbridge for the erection of a power plant.

SEATTLE, WASH.—Ordinance proposing an additional unit to the existing municipal steam power plant of the city has been passed and gone to the mayor.

TWIN FALLS, IDAHO.—R. F. Lewis, attorney for the Elkoro Mines Company, states that a water right for the generation of power has been located on the river near Jarbridge.

TERRY, MONT.—The Terry Development Company has been organized to engage in electric light and power business, and has purchased the Terry Light & Power Company. It will install a steam outfit.

CASHMERE, WASH.—Mayor Jones reports that Arthur Gunn, president of the Wenatchee Valley Gas & Electric Company will submit to the council at the next meeting a tentative contract for furnishing power to the town of Cashmere.

NORTH YAKIMA, WASH.—President H. M. Gilbert of the Tieton Water Users' Association, will look into the matter of the possibilities of a hydroelectric plant on the present Tieton Canal and at the McAllister Meadows. About 100,000 h.p. is being considered.

HANFORD, CAL.—Sealed bids will be received by the board of supervisors up to January 2, 1917, for a franchise granting the right to construct and for a period of 50 years to operate an electrical pole and wire system upon the public roads in King county.

SEATTLE, WASH.—Superintendent of Lighting J. D. Ross has been requested to furnish estimates of the cost of a transmission line for the purpose of connecting Seattle with the Tacoma municipal power plant in order to take advantage of the Tacoma rate for current.

HORNBROOK, CAL.—The dam of the Northern California Power Company across the Klamath River near Copso is now under construction. Below the dam a large power house is being built where two generators with a capacity each of 12,500 h.p. will be installed.

COQUILLE, ORE.—F. E. McKenna, Coquille manager of the Oregon Power Company, states that the Byllesby people have approved the project for a 11,000 volt transmission line between Marshfield and Coquille, and that the right of way for the line is practically all secured. The construction of this line will cost \$16,000.

TACOMA, WASH.—Superintendent of the municipal light plant, Llewellyn Evans, is looking into the question of a site for a new hydroelectric power plant, as he says the maximum of the present plant will be reached by 1921. The city council is favorable to starting on the plant now, as it will require three years to duplicate the present plant. The estimated cost is \$2,000,000.

RIVERSIDE, CAL.—It has been announced that the City Electric Supply Company of this city has been awarded the contract for building all the power lines, telephone lines,

three transformer substations, and installing all power and light wiring and switchboard work on the Terra Bella Irrigation project at Terra Bella in Tulare county. The amount of contract is \$44,400.

TELEPHONE AND TELEGRAPH.

PORT MOODY, B. C.—The British Columbia Telephone Company will not erect its exchange building here until spring.

WINNEMUCCA, NEV.—The Golconda Telephone & Power Company has been granted a franchise to extend its lines through the towns of Rochester and Lovelock.

HOQUIAM, WASH.—P. H. Roundtree, Inc., applied to the county commissioners for permission to build a telephone line from this place west to Pacific Beach and Moclips.

SPOKANE, WASH.—The expenditure of \$32,560 in telephone betterments in Spokane and the Inland Empire has been authorized by the head offices of the Pacific Telephone & Telegraph Company in San Francisco.

WASHINGTON, D. C.—Bids will be received by the bureau of yards and docks up to December 18 for a telephone cable connection between the Keyport torpedo station and the Bremerton navy yard, also for an electric transmission line.

VALDEZ, ALASKA.—The Prince William Sound Water, Light Power & Telephone Company, a Seattle corporation, has purchased the Hles Hydroelectric Company of this place for about \$100,000. Besides furnishing light power and heat for Valdez, Liscom and other villages in the district, the Prince William Sound Company owns and operates a telephone system. Both plants will be operated by the company until extensions are made which will consolidate the plants at the hydroelectric site here.

SEATTLE, WASH.—The Kilbourne & Clarke Manufacturing Company has received a \$400,000 contract from Hannevig Bros. of Norway and New York for equipping 170 steamships with its Seattle-made wireless apparatus. The contract covers the entire fleet controlled by Hannevig Bros., including ships now afloat and in operation and ships under contract in American and Holland shipyards. In addition to this the contract reaches greater proportions than the amount specified, as it includes all the ships that Hannevig Bros. may own or control for the next three years.

IRRIGATION.

MODESTO, CAL.—Sealed proposals to construct portions of the main canals of the Waterford Irrigation District, will be received by the board of directors until December 19th, at Waterford, Cal. Plans and specifications may be seen at the office of the board.

MARYSVILLE, CAL.—A system of drainage is being planned by the newly appointed trustees of Reclamation District No. 1600 of Sutter County; W. C. Hoke, P. H. McGrath and E. S. Brown; for the purpose of carrying water from the tule lands and making the land suitable for bean raising. For years this land has been a celebrated duck preserve.

STOCKTON, CAL.—Land owners in the West Side Irrigation District voted in favor of \$295,000 bond issue to furnish funds for the construction of the district's canals, pipe lines and pumping station. The bonds will bear interest at 6 per cent and will be payable in 40 years. No time will be lost in starting work. The district is about 8 miles long.

SAN BERNARDINO, CAL.—A petition for the formation of the Mojave River Irrigation District to water the east side of Victor Valley, has been filed with the board of supervisors. There are two factions, one backing the district to embrace only the east side and the other seeking the formation of a greater project, calling for the reclamation of land on both sides of the river and the acquirement of properties of the Arrowhead Reservoir & Power Company.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

- | | |
|--|--|
| A-1 American Ever-Ready Works of National Carbon Co
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco. |
| B-1 Baker-Joslyn Company.....
71 New Montgomery St., San Francisco; 911 Western
Ave., Seattle; 353 E. Second St., Los Angeles. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco. | N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San
Francisco. |
| C-1 Century Electric Co.....
906 So. Hope St., Los Angeles; 56 Natoma St., San Fran-
cisco; 65 Front St., Portland, Ore. | N-3 National Lamp Works of G. E. Co.....
(All Jobbers.) |
| C-3 Crocker-Wheeler Co.....
87 New Montgomery St., San Francisco; 228 Central
Avenue, Los Angeles. | N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland,
Ore.; San Fernando Bldg., Los Angeles. | N-6 National Carbon Co.....
Cleveland, Ohio. |
| D-4 Davis Slate & Manufacturing Co.....
Chicago, Ill. | O-1 Okonite Co. (The).....
(All Jobbers.) |
| D-2 Dearborn Chemical Company.....
355 East Second St., Los Angeles; 301 Front St., San
Francisco. | P-2 Pacific States Electric Co.....
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth
St. No., Portland; 200-210 Twelfth St., Oakland; 575
Mission St., San Francisco; 307 First Ave. So., Seattle. |
| E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los
Angeles. | P-4 Pelton Water Wheel Co.....
2219 Harrison St., San Francisco. |
| E-2 Edison Storage Battery Co.....
206-8-10 First St., (near Howard), San Francisco. | P-5 Pierson, Roeding & Co.....
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San
Francisco; Colman Bldg., Seattle. |
| E-3 Electric Agencies Co.....
279-283 Minna St., San Francisco; 419-421 E. Third St.,
Los Angeles. | P-7 Pittsburgh Piping & Equipment Co.....
Monadnock Bldg., San Francisco. |
| E-4 Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco. | S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco. |
| E-5 Electric, Railway & Manufacturing Supply Co.....
34 Second St., San Francisco. | S-4 Southern Pacific Co.....
Flood Bldg., San Francisco. |
| E-6 Electric Novelty Works.....
533 Mission St., San Francisco. | S-5 Sprague Electric Works.....
Rialto Bldg., San Francisco; Colman Bldg., Seattle;
Corporation Bldg., Los Angeles; Electric Bldg., Port-
land; Paulsen Bldg., Spokane. |
| E-7 Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago. | S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian
Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815
Newhouse Bldg., Salt Lake City, Utah. |
| F-3 Federal Sign System (Electric).....
618 Mission St., San Francisco. | T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co.,
Pacific Coast Representatives. |
| G-1 General Electric Co.....
724 So. Spring St., Los Angeles; Worcester Bldg., Port-
land; Rialto Bldg., San Francisco; Colman Bldg.,
Seattle; Paulsen Bldg., Spokane. | T-2 Tubular Woven Fabric Company.....
Pawtucket, R. I. |
| H-1 Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.) | U-1 United Sheet Metal Works.....
575 Howard St., San Francisco. |
| H-2 Hemingray Glass Co.....
236-240 So. Los Angeles St., Los Angeles; 345 Oak St.,
Portland; 807 Mission St., San Francisco. | W-1 Wagner Electric Manufacturing Company.....
St. Louis, Mo. |
| H-3 Haller-Cunningham Electric Co.....
428 Market St., San Francisco. | W-2 Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph
Ave., Oakland, Cal.; 630 Folsom St., San Francisco; 907
First Ave., Seattle; 45 North Fifth St., Portland, Ore. |
| H-4 Hubbard & Co.....
(See Pacific States Elec. Co.) | W-3 Ward-Leonard Electric Co.....
Mt. Vernon, New York. |
| H-7 Hurley Machine Co.....
New York and Chicago. (See Pacific States Electric Co.) | W-4 Westinghouse Electric & Manufacturing Co.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los
Angeles; Couch Bldg., Portland; 212 So. W. Temple,
Salt Lake City; First National Bank Bldg., San Fran-
cisco; Second and Cherry Sts., Seattle; Paulsen Bldg.,
Spokane. |
| I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles. | W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.) |
| I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco. | W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway,
Los Angeles. |
| L-1 Leahy Manufacturing Co.....
Eighth and Alameda St., Los Angeles. | |
| L-2 Locke Insulator Manufacturing Co.....
(See Pierson, Roeding & Co.) | |
| M-2 McGlauffin Manufacturing Co.....
San Rafael, Cal. | |
| M-3 Moore & Co., Charles C.....
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland;
Kearns Bldg., Salt Lake City; Sheldon Bldg., San Fran-
cisco; Mutual Life Bldg., Seattle; Santa Rita Hotel
Bldg., Tucson. | |

JOURNAL OF ELECTRICITY

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Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, DECEMBER 16, 1916

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AMERICA'S ELECTRICAL WEEK ON THE
PACIFIC COAST.

A NEW METHOD FOR THE MEASUREMENT OF
THE DIELECTRIC CONSTANT.

BY J. PARKER VAN ZANDT.

THE SINUSOIDAL WAVE METHOD OF RADIO
TELEGRAPHY.

BY WALTER HAYNES.

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Brushes
National Carbon Co.

Conduit and Loom Boxes
Sprague Electric Co.

Batteries
Edison Storage Battery Co.

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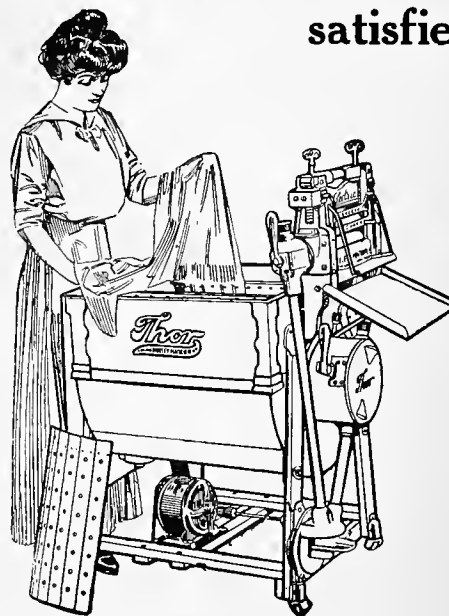
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The Modern Electrical Supply House

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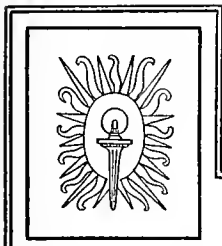
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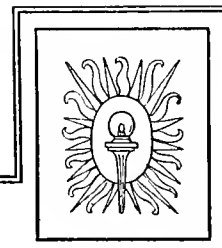
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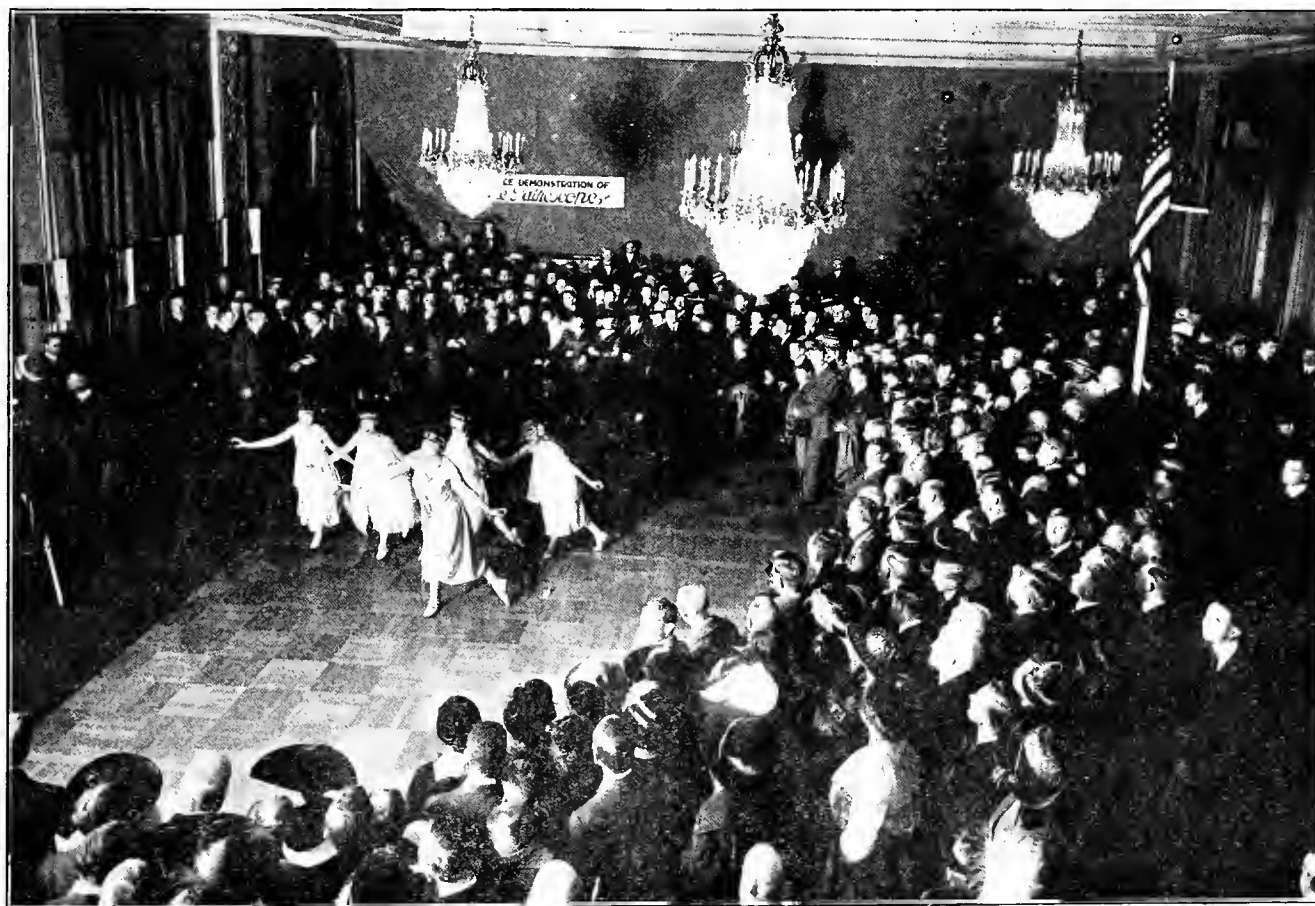
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AMERICA'S ELECTRICAL WEEK ON THE PACIFIC COAST

America's Electrical Week will go down in history as the greatest single sales campaign ever conducted on the Pacific Coast. From Seattle on the north to San Diego on the south, from San Francisco in the

modern Aladdin presses to summon the great genie Electricity.

It is as yet too soon to give detailed figures of sales increase. For the present it is sufficient to re-



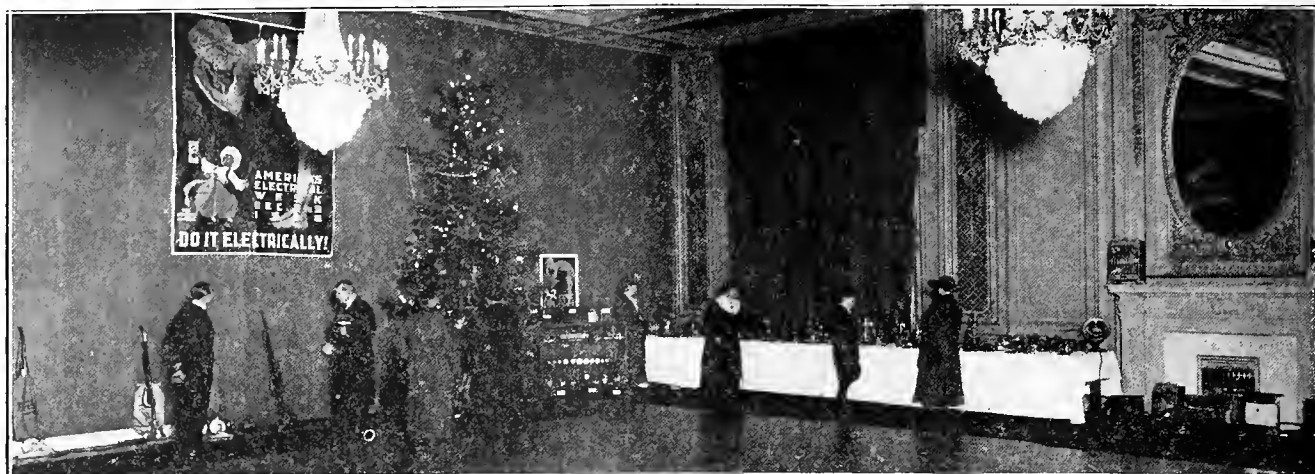
Crowd at San Francisco Electric Show Opening Night.

west to Salt Lake City in the east, collective energy and enthusiasm produced unhopd for results.

These results have materialized directly in a tremendous stimulation in the sale of electrical devices and indirectly in an enhanced appreciation of the value of central station electric service. The people bought appliances and are using them with a clearer understanding of all the tremendous investment and care which stands behind the electric button which the

cord what was done in each community to attract attention, induce interest and develop desire to "do it electrically."

In general, the favorite attraction was the electric show. Co-operative newspaper advertising, billboard displays, street car cards, and special invitations brought throngs of visitors. Luncheon meetings addressed by prominent electrical leaders were popular. The schools were reached by special lecturers and the



Vacuum Cleaner, Flashlight, Table Appliance and Glow Stove Exhibit at San Francisco.

women's clubs by demonstrations. Every electrical dealer in the West put forth special efforts in providing window displays and store demonstrations. Tons of literature and poster stamps were distributed by the central stations.

San Francisco's Activities.

The most comprehensive campaign was conducted in San Francisco. Two weeks before the opening of the week sixty-eight 24 sheet billboards were up throughout the city. These carried the Aladdin poster together with a message "celebrate Christmas electrically" which will continue to remind the shopper of the value of electrical gifts until the 20th of December.

On Thanksgiving day 1300 announcements of the electric show appeared in the cars of the United Railroads and the "week" was ushered in by electrical pages in the newspapers.

The show consisted of a select exhibit of electrical household appliances attractively displayed in the beautiful ballroom of the Palace Hotel. It was officially opened on Saturday night, December 2, under the auspices of the Electrical Development and Jovian League by the Hon. Frank Devlin, member of the Railroad Commission of the State of California. After an appropriate introduction by R. E. Fisher, vice-president of the League, Mr. Devlin told of the marvellous accomplishments of electricity and turned the switch controlling the special illumination features.

First of these was a beautiful American flag which was unfurled to the breeze of electric fans and flood-lighted while the hall was in darkness. A squad from the National Guard raised the flag and sounded reveille. The effect of the inspiring spectacle on the 1500 men and women in the audience was remarkable. Patriotism was aroused in every breast and the full meaning of America's Electrical Week realized. An electrically lighted Christmas tree also burst into radiance at the same time. A group of dancing girls entertained the crowd during the rest of the evening while the guests themselves were not dancing.

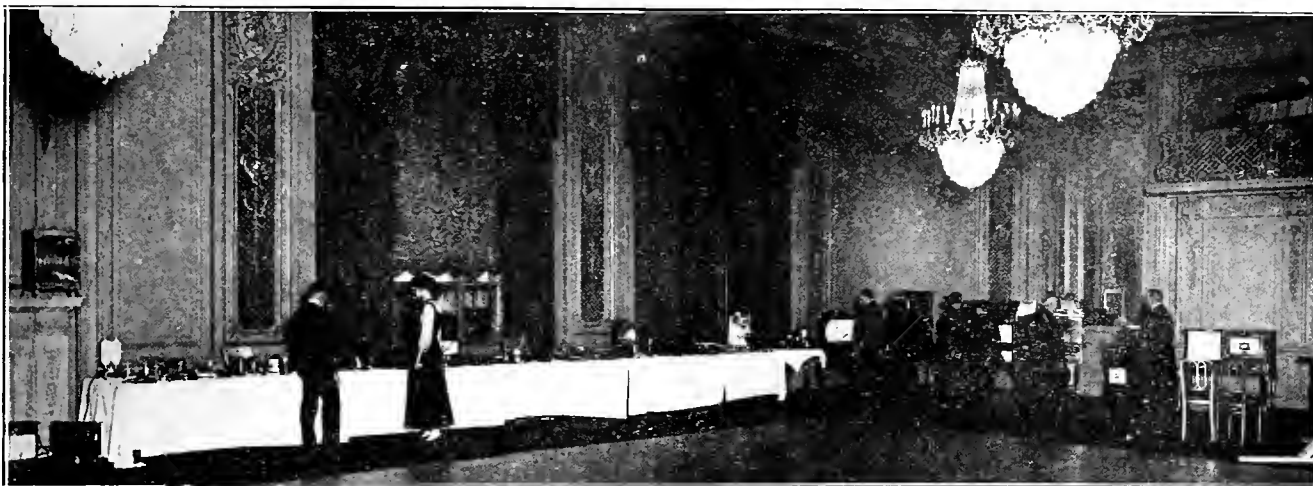
Each evening throughout the following week was in charge of some one of the affiliated electrical organizations. On Monday night the electrical contractors were hosts, on Tuesday the United Railroads, on Thursday the electrical manufacturers, on Friday the

Pacific Telephone & Telegraph Company and on Saturday the central stations. Special entertainment was provided in each case.

Electrical luncheons were also held in the hall throughout the week. On Monday the Electrical Development and Jovian League turned out an attendance of 150 members.

On Tuesday the Rotary Club to the number of 241 were the guests of the eleven electrical members who had provided special displays of their own products for the occasion. Geo. C. Holberton, manager of the San Francisco district of the Pacific Gas & Electric Company, was the honorary chairman and W. S. Coleman of Pacific Service the presiding officer. After a brief address on the Significance of America's Electrical Week by A. H. Halloran, managing-editor of the Journal of Electricity, as Pacific Coast representative of the Society for Electrical Development, Mr. Coleman read joking telegrams introducing the electrical Rotarians. R. M. Alvord of the General Electric Co., Clyde Chamblin of the California Electric Construction Co., D. E. Harris of the Pacific States Electric Co., John Hepburn of the California Electric Construction Co., Jos. Hutchison of the Novelty Electric Sign Co., Samuel Ickelheimer, dealer in electrical fixtures, J. C. Manchester of the Interstate Electric Novelty Co. (who also distributed Franco flashlights to all present), Chas. E. Thatcher of the Western Union Telegraph Co., and Jos. Thieben of the Panama Lamp Co., each telling briefly the good points of his product. Mr. Holberton then introduced Dr. Thomas Addison, Pacific Coast manager of the General Electric Company, who gave a masterly address on "Paths of Electric Progress." This address briefly reviewed the recent accomplishment of the electrical art, lamps, railways, generators, transmission, ship propulsion, and railway electrification, together with a forecast of the future, concluding with statistics regarding California's electrical pre-eminence.

On Tuesday, also, the electrical men were the guests at a joint luncheon of the Chamber of Commerce and Commercial Club, where 300 men listened to talks by F. J. Koster and A. B. C. Dohrmann. Mr. Koster emphasized the growth of the electrical industry and bespoke fair treatment of the power companies. Mr. Dohrmann illustrated the possibilities of co-operative publicity and education of business men in



Lamp Socket Devices and Electric Ranges at San Francisco Exhibit.

better business methods by means of the work being accomplished by the Society for Electrical Development.

A joint meeting of the Downtown Association and Ad Club in the ballroom of the Palace Hotel on Wednesday was addressed by Mr. Geo. C. Holberton of the Pacific Gas & Electric Co. on the subject "What Stands Behind the Electric Switch." On Thursday Mr. Albert H. Elliott, secretary of the Pacific Coast Jobbers' Association gave an eloquent address on the "Electrical Conquest of the World," before the Home Industry League, this meeting also being held in the Palace Hotel ballroom, with an attendance of 175 members. Mr. Elliott's talk was much the same as reported in the activities at Sacramento.

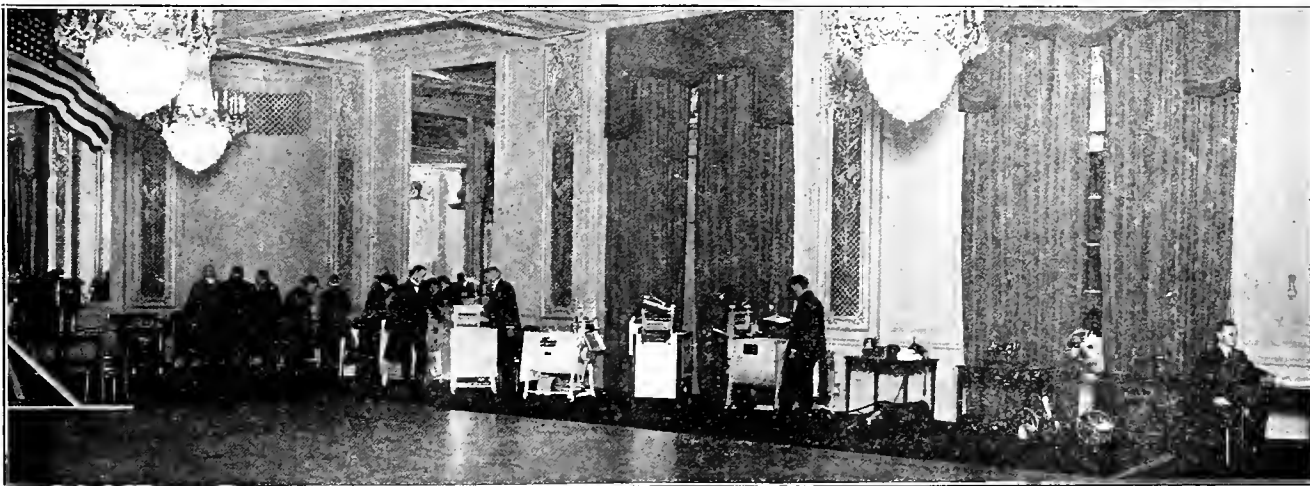
The show was planned as a strictly educational, non-competitive exhibit of electrical devices. The exhibits were installed by the manufacturers and jobbers, no dealer participating directly in the show. All appliances were grouped as to kind, i.e. all ranges of different makes were at one end of the hall, all vacuum cleaners at the other, etc. No special display signs were allowed and the only literature distributed was a classified catalogue of exhibits giving the names of dealers from whom the apparatus might be purchased. A large Federal electric sign in the hotel lobby directed visitors to the ballroom. Moving pictures of electrical subjects were shown together with a special exhibit

by the Pathescope. A conservative estimate shows that an average of 2850 people visited the show daily, giving a total of more than 17,000 during the six days that the exhibit was open to the public.

During the week John Varney of the Pacific Gas & Electric Company, Waldo Cole of the Westinghouse Electric & Manufacturing Co., and Henry Holland of the Great Western Power Co. lectured in the high schools before over 2000 students, driving their arguments home by means of moving pictures.

Aside from the credit due to the members of the general committee having the arrangements in charge, special mention should be made of the work of the committee of arrangements, consisting of S. V. Walton, F. H. Leggett, E. B. Strong, R. M. Alvord and P. C. Butte as well as of the efforts of the finance committee, T. E. Bibbins, F. H. Leggett and C. E. Heise. R. E. Fisher had charge of the electric show, M. S. Orrick acted as general chairman of the entertainment committee, L. E. Voyer erected the electric flag, F. S. Myrtle handled the publicity, the American Ever Ready Co. furnished the Christmas tree. Particular thanks is due to the United Railroads of San Francisco for many privileges extended and to the San Francisco newspapers for their liberality with space. A. H. Halloran managed the entire campaign.

All interests have expressed themselves as extremely well satisfied with the results. The campaign



Ranges, Washing Machines and Sewing Machines at San Francisco Exhibit.

greatly exceeded that of last year because of the wide publicity given. Plans are already being laid for a similar campaign in 1917 with a much more comprehensive electric show as the big drawing card.

Celebration at Oakland.

A well-arranged and well-attended electric show at Fourteenth and Webster streets represented Oakland's participation in America's Electrical Week. Placards in the street cars and notices in the newspapers sufficed to bring a large and interested crowd. In addition four street cars were fitted with electric signs calling attention to the week's activities.

The show was held in a vacant store at a prominent corner close to the center of the city. The participants were the dealers of the city, each of whom equipped a typical room electrically. The living-room was furnished by Spott Bros., with table lamp, glowers, Victrola, electric piano, Christmas tree and vacuum cleaner. The Pacific Coast Specialty Company had charge of the dining-room, in which was displayed a complete line of table appliances, an air heater and a vacuum cleaner. The bedroom was equipped by the Oakland Electric Company, with water heater, curling irons, warming pads and air heater. The kitchen was furnished by the Kimball Electric Company, with a range, ovenette and cleaner, and the laundry by the Piedmont Electric Company, with washing machine, ironer, dish washer and flatirons.

Additional exhibits were made by the Berkeley Electric Construction Company and Spott Bros., consisting of heating appliances, sewing machines, electroliers, Junior ranges, grills, telephones and hot plates. The Electrical Construction Company showed a switchboard, the Conrad Electric & Motor Company a full display of small motors, the Pacific Telephone & Telegraph Company a private branch exchange and a telephone booth, the Maxwell Hardware Company portable lamps and vacuum cleaner, Rauch & Lang a worm gear drive, and Gray & Son a washing machine and scales.

A large electric sign on the roof, a brilliant lamp display and electrical toys in the windows were effective features in attracting attention. Meetings of the Rotary Club and the manufacturers' bureau of the Chamber of Commerce were also addressed by Frank Leach and E. O. Shreve, respectively.

Under the direction of Chairman F. H. Woodward, Henry Mellman acted as chairman of the exhibit committee, Geo. Furniss of the finance committee, Norman Ellis of the furnishing committee (John Breuner Co. supplying all furniture), and E. C. Wilson in charge of decorations and securing exhibitors.

Tacoma's Participation.

Tacoma participated in America's Electrical Week with an electric show, which proved a success both from the viewpoint of the exhibitors and as an educational proposition, as shown by the large crowds attending the show. This was Tacoma's first electric show, but from present indications would seem that it should be a yearly event. The show was held in a building which already housed a permanent manufacturers' and jobbers' exhibit, the electrical exhibits being placed in all the available vacant spaces. On Wednesday, December 6th, a special electrically cooked luncheon was served to the women's clubs

of the city. Twenty-four-sheet billboards were displayed throughout the city, consisting of two Modern Aladdin posters on either side of an eight-sheet poster. "See what's new. America's Electrical Week, December 2-9, Tacoma Building. Everybody invited. No admission fee."

Aberdeen's Show.

Aberdeen, Wash., celebrated the week by holding an "Electric Show," giving \$20 in cash prizes for best essays from the grammar and high school grades on "Electricity in Everyday Life," and offering special prices and free lamps to all placing an order for wiring an old house during the week. The "show" went very successfully. The essay contest caused a tremendous interest among the school children. The housewiring scheme did not bring results very fast, but was nevertheless worth the effort.

The "show" was held in a big, vacant storeroom in the best downtown business section. A large flag in front of the building, five large flood lights on tops of buildings across the street, an arch of eleven 1000 watt type C mazdas across the street in front, a big sign painted "Electric Show. Do It Electrically" focused attention on the show inside. The Seattle jobbers sent down a lot of exhibits, and also each sent a man for a few days, and this, together with the material which the other electric contractors and the Puget Sound Traction, Light & Power Company were able to collect, made a very good showing. The booths were gaily decorated, the electric Victrola made music continually, and the electrically driven job press attracted a great deal of attention. The washing machines and vacuum sweepers in operation were interesting, the meter booth was always surrounded and the hot coffee and toast were popular. Plenty of attendants were on hand to explain the workings of all apparatus on display. "Do It Electrically" was preached to them from the time they entered the door until they left.

The show was open evenings only from 7 to 10:30, admission being free and no sales solicited. Free return car tickets were given to those who came on the cars to attend, a special conductor's check being evidence of carfare paid coming and a return pass issued at the show.

A free drawing was held each evening and a good electric device given away, iron, toaster, percolator, lamp, etc. The attendance averaged over 1500 each evening.

Rome C. Saunders, assistant sales manager of the Puget Sound Traction, Light & Power Company, who managed the affair, states that "the interest has been very good, and we feel that although it costs a good deal to put on such a show, it is going to have lasting results."

Butte's Boosting.

The Montana Power Company filled the city with twenty-four-sheet posters proclaiming America's Electrical Week and an Electrical Christmas, ran considerable display advertising in the daily papers, and obtained considerable additional publicity. As their offices and salesrooms have a large and attractive frontage on Broadway, the principal business thoroughfare, they put in an elaborate window display.

In the window on one side was a log-cabin scene, illuminated by candles, with the old stone fireplace and chimney, the walls and roof and the coffee-pot and cooking utensils all smoked up—and, on the whole, quite a realistic scene representing the typical Butte home thirty years ago. In the window on the opposite side of the building, was the kitchen and dining-room scene in an up-to-date home of today, the cooking being done on an electric range, as well as the electric percolator and toaster and other electrical devices being shown in use. Everything in this scene was, of course, done in the latest and most up-to-date way—electrically. The illumination was taken care of here with the latest type of Edison Mazda lamps arranged so as to get the best possible results. A placard up in front stated that from a comparison of the two windows one will get a conception of what electrical progress has done for the home.

One of the big factors in the campaign was the hearty co-operation of the Montana Federation of Women's Clubs throughout the state. At the meetings of the different clubs of their organization they discussed the merits of the application of electricity to home life and the use of electrical devices and appliances both from a labor-saving and economical standpoint. The interest thus aroused in the thousands of housewives and mothers throughout the state of Montana will be of inestimable value toward the furtherance of electrical progress as it applies to home life. This co-operation of the Montana Federation of Women's Clubs in the celebration of America's Electrical Week will bring great good, indicating as it does that the women of our country are beginning to realize the many advantages of using things electrical.

J. A. Colliton, of the company's sales and service department, was in active charge of the campaign. He advises that, "on the whole, we believe that we have aroused a great deal of interest throughout the state of Montana in the observance of America's Electrical Week, and that some good will surely be accomplished."

San Diego's Campaign.

The San Diego Consolidated Gas & Electric Company co-operated with ten electrical contractors of San Diego in holding what is reported to be one of the most comprehensive and attractive shows held in the West. The show was open from 2 p. m. till 10 p. m. each day from December 2 to 9, and was given a great deal of publicity through the newspapers. The show occupied a space 50x150 ft. in the entire second floor of the Arcade building. Music was furnished by a five-piece orchestra, and dancing enjoyed by those who so desired. The attendance was large and the sales very good.

North Yakima's Participation.

At North Yakima, Wash., the publicity for America's Electrical Week consisted of billboard displays, special window displays by the Pacific Power & Light Company and the four electrical dealers, the trims being changed several times during the week. Special displays in the salesrooms of these places of business was made.

The power company ran a special, selling toasters

for \$2.50 each, and also offering a 40-watt Mazda lamp with each appliance sold during the week.

Reno's Publicity.

Two weeks previous to December 2d some full page advertisements were run in the daily papers featuring the objects of the Society of Electrical Development, and using much of that society's material relating to the importance of the electrical industry.

An unfortunate accident destroyed one show window, but the remaining one attracted much attention. It consisted of a gigantic reproduction of the Aladdin poster, made of vari-colored fabrics. The genii figure formed the background with life size Aladdin in the foreground. Aladdin was articulated. In operation his arm moved to the switch, which was actuated by an invisible mechanism, and in doing so turned on concealed lights which brought into view the figure of the Genii. The illusion was very successful. A nine-point flasher which controlled the various movements was wired up in plain view to show how the various effects were obtained.

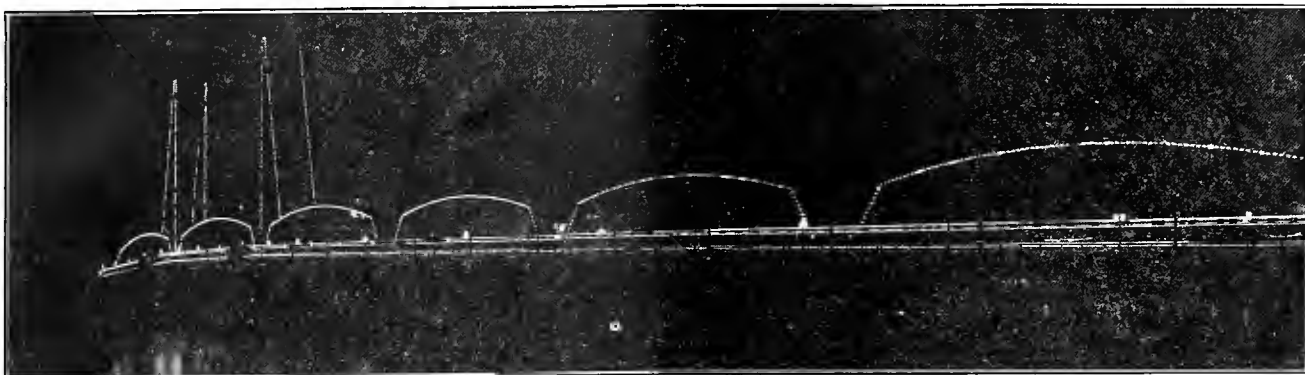


An Articulated Aladdin at Reno.

The Reno Power, Water & Light Company's office was elaborately decorated in the colors of the official poster with a number of tables on which were percolators and toasters connected and ready for operation. Young ladies were present to assist the guests in the preparation of toast and coffee, if necessary, but visiting ladies were urged to try the appliances themselves, which most of them did to their great delight. After the second day the affair easily became a sort of continuous party.

During the week all electrical devices, except ranges were sold at a twenty per cent discount—this discount however being payable in Mazda lamps. One year ago a straight discount was used but it was found that a discount in lamps, or other merchandise, is more effective than a cash discount.

No effort was made to force sales. Instructions were to make everybody have a good time, and glad to come again; but the sales show a better week



Illumination of Portland's Bridges.

than last year, although that was considered very successful. This is somewhat of a surprise because it was feared that the advanced prices in electrical appliances would reduce the number of sales. Such does not seem to have been the case however.

Portland's Participation.

At Portland the chief attraction was a mammoth electrically lighted Christmas tree in the middle of a prominent downtown street. The numerous colored lights on this tree were operated by a flasher, which gave a very pleasing effect. The tree was surmounted by a large star outlined in white Mazda lamps, this star being 6 ft. in diameter. The tinsel, medallions.



Electric Christmas Tree at Portland.

etc., with which the tree was decorated, were effectively brought out by flood lighting from a near-by building. A band concert was held here on the last night of the week.

At a number of prominent downtown street intersections papier-mache genii similar to the one shown on the Electrical Week poster were erected. These genii were illuminated from the pedestal on which they stand through a green glass. This pedestal also had transparent glass signs on each side with such slogans as "Do It Electrically" and "Give Electrical Christmas Gifts," etc.

Along the principal downtown business streets the boulevard posts were decorated with greens and festoons strung between the posts, adding materially to the holiday atmosphere of the shopping district.

The five bridges crossing the Willamette River in Portland were illuminated each night by outline lighting.

The Northwestern Electric Company operated an attractive illuminated steam curtain on the roof of a prominent downtown building, which called forth considerable favorable comment from pedestrians.

At thirty different locations in the various parts of the city twenty-four sheet posters were put up, one-third of which was taken up with the Electrical Week poster furnished by the society, the remaining two-thirds being devoted to general advertising of electrical Christmas gifts and electrical appliances.

Electrical talks were given by men prominent in the local electrical industry at the luncheons of the various civic organizations, such as the Rotary Club, Ad Club, Chamber of Commerce, Progressive Business Men's Club, etc.

A contest was put on for the best electrical window display, with two sets of prizes, one for electrical dealers and the other for non-electrical concerns. In the first class the first prize was won by the Morrison Electric Company, the second prize by E. L. Knight & Co. In the second class the first prize was won by Meier & Frank Company, and the second prize by Olds, Wortman & King, two of the largest department stores in the city. A large number of other very attractive window displays were made by both electrical and non-electrical dealers, prominent among which were the displays of Woodard-Clarke Drug Company and Smith-McCoy Electric Company.

Electrical Week cards were on display in six hundred of the Portland street cars for the two weeks preceding the week. The electrical interests co-operated in running an electrical page for a number of times in the three leading papers.

A number of large electrical week banners made up of the 7 by 9 ft. posters mounted on a wall mat backing, were found to be very effective use for these in a number of prominent windows, and in such locations as the rooms of the Chamber of Commerce.

The plants of the local telephone companies and the light and power companies were thrown open to visitors.

A number of the Electrical Week wagon banners have been put in circulation on the wagons of some of the department stores, and of course, on those of all of the electrical firms in the city.

A large number of the poster stamps were put out by the department stores on their delivered pack-

ages, probably 50,000 stamps being put in circulation in this manner alone.

Approximately 40,000 of the Electrical Week folders were distributed to electrical consumers with the bills of the Portland Railway, Light & Power Company, and also those of the Northwestern Electric Company. In this way a personal announcement has been made to practically every electrical consumer in Portland.

The Electrical Week slide was shown in practically all of the moving picture and vaudeville houses in Portland.

Los Angeles Contractors.

Due to the uncertainty regarding the future ownership of the distribution systems in Los Angeles, the several central stations did not participate actively in the week's celebration. The contractors and dealers, however, made excellent displays in their windows and stores, showed on many billboards throughout the city and did some excellent advertising in the newspapers. Several civic organizations were addressed on electrical subjects and a big Jovian rejuvenation was held on Friday night, December 8th. The Southern California Edison Company also carried on a heavy advertising campaign on electrical appliances throughout 60 towns in Southern California.

Stockton's Participation.

At Stockton, California, the Western States Gas & Electric Company joined with the electrical contractors and dealers in an effective series of window and store displays. The Western States Gas & Electric Company erected two attractive booths decorated with purple and gold in their salesrooms and here assembled a complete exhibit of lighting, heating, cleaning and cooking devices. Those contributing to the display were: Electric and Machine Equipment Company, Electric Engineering & Supply Company, Edward L. Gnekow, Goold & Johns, Gould the Light Man, Home Electric Company, Patzer's Electrical Works, Noble D. Powell, Tiffany's, Harry S. White, Electrical Contractor, Commercial Electric Company, Lyman Electric Company, The Ruhl-Goodell Company, Willard Hardware Company, A. Alberti and Branch's (Inc.)

A big campaign of newspaper and billboard publicity was instrumental in attracting large crowds. Electrical musical concerts were held each evening. The Elks' building was flood-lighted and a large electric siren afforded audible evidence of the show's location. H. S. Batchelder commercial agent of the Western States Gas & Electric Company, had charge of the week's activities.

Sacramento's Success.

Sacramento's beautiful show in the banquet room of the Hotel Sacramento was opened Monday evening, December 4th, by an electrical dinner where ninety-two of Sacramento's electrical men assembled. The chief speaker of the evening was Albert H. Elliott, secretary of the Pacific Coast Electrical Supply Jobbers' Association, who gave a masterly address on "Electricity, the Friend of Man." J. C. Hobrecht also told of the use of electricity in every day life. The show itself was noteworthy for the faintness and

effectiveness of the display. It included heating and cooking devices, automobile accessories, kitchen and laundry equipment and musical, telephone and telegraph instruments. The committee of arrangements consisted of Chas. W. McKillip, Carl Beaton, J. C. Hobrecht, Thomas Scott, C. V. Schneider and W. B. Camp, the latter managing the campaign.

The Week in Utah.

Entering into the spirit of America's Electrical Week enthusiastically, the electrical industry of Utah participated in the observance of the event this week to a much greater extent than last year and with the certainty of beneficial and very material results accruing. Over 150,000 pieces of literature on America's Electrical Week, including leaflets, posters, poster stamps, street car banners and window lithographs, were distributed to the people of the state. In addition, approximately 100 different newspaper advertisements, each averaging 20 inches, were used in the city and country newspapers of the state to advertise America's Electrical Week.

A great deal of publicity has been contributed by the newspapers and a total of some 25 mercantile firms, outside of the electrical industry, dressed their show windows electrically this week in observance of the event. The larger towns in the state celebrated with electrical bazaars, special merchandise sales and specially decorated store interiors, so far as electrical companies are concerned.

In Salt Lake, in addition to the large amount of advertising in the newspapers and literature distributed, a large number of display windows, both in and out of the electric industry, carried electrical displays; the Utah Electric Club had as its guests at the Commercial Club on Wednesday evening the members of the Transportation Club and members of the various engineering societies of the city and state, to witness the first presentation here of the motion picture history of transportation in the United States, entitled "The King of the Rails." The same film was shown to the members of the Rotary Club at a special dinner Tuesday evening, December 5, as a feature of the event.

At Ogden, Utah, a large electrical show was held, participated in not only by the electrical interests of that town, but by those manufacturers who use electrical service.

America's Electrical Week has been more generally and fully observed by the electrical industry and participated in to a greater extent by the general public than any similar event in the history of the state.

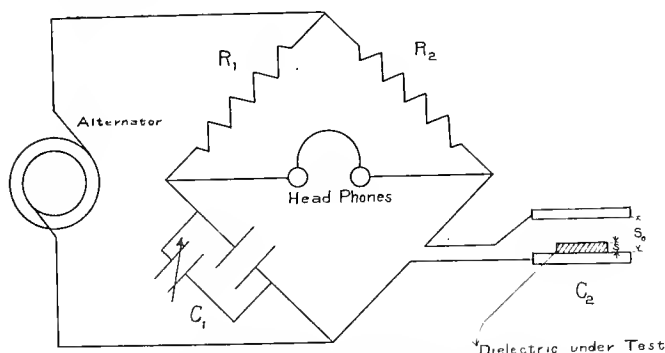
CONCESSIONS FOR OIL DOCKS AT PERUVIAN PORTS.

The Government of Peru has granted concessions to the West Coast Oil Fuel Company for the construction of iron docks at Callao and Paita. These docks will be used exclusively for the loading and unloading of oil consumed by incoming and outgoing steamers. Pipe lines will carry the oil from the tanks of the company to the docks. The traffic of the oil docks will be subject to the usual port and customs regulations. The concessions, as published in *La Revista Comercial*, are for a period of 25 years from the date of the opening of the docks to service.

A NEW METHOD FOR THE MEASUREMENT OF THE DIELECTRIC CONSTANT.

BY J. PARKER VAN ZANDT.

The importance of a knowledge of the values of the dielectric constants for various dielectrics has led to the development of certain methods of measurement¹ whereby the desired constants may be obtained. These methods have proved adequate for precise measurements within the degree of accuracy required in determinations of this character and it is not the purpose of this article to offer any new arrangement permitting greater precision.



A Short and Ready Method for Making Connections in Determining the Dielectric Constant.

If, however, it is desired to make a rapid and approximate determination of the dielectric constant of a given material, certain serious difficulties will be found in the use of the more precise methods. In the older arrangements the capacity of a given condenser is measured when the plates are separated by air by the use of some form of an electrometer, usually the Kelvin Absolute Electrometer². The change in electric stress and consequent change in the electrometer readings upon the introduction of the dielectric whose specific inductive capacity is desired is related in a pre-determined way with the dielectric constant of the specimen under test. For anyone who has worked with an absolute electrometer it is needless to comment upon the difficulty of making rapid and easy determinations with such an instrument. A case has recently come to the writer's attention of an incident which occurred in one of the universities of the Middle West. In connection with a research problem it was desired to know the dielectric constant of a certain piece of glass. A Kelvin Absolute Electrometer was used and after some difficulty a set of readings was obtained for the capacity of the given condenser when the plates were separated by air. The piece of glass which was then introduced was found to have acquired an electric charge; the disturbing effects of this charge were not greatly lessened by passing the glass through a flame. Readings, however, were finally obtained and upon substitution in the formula a negative dielectric constant resulted. The following day a fresh attempt was made, but when the readings were substituted in the proper expression the denominator became zero, indicating an infinite dielectric constant.

¹ J. Henderson: Practical Electricity and Magnetism, Third edition, 1908. See paragraphs 254-265 and list of references to scientific papers.

² J. J. Thomson: Elements of the Mathematical Theory of Electricity and Magnetism pp. 97-98 et seq.

The attempt was then abandoned awaiting a better method of measurement. The arrangement to be described below was first suggested to the writer by Professor F. E. Pernot of the University of California and is thought to meet the requirements of a method permitting a rapid and easy determination of the dielectric constant.

Let us review briefly the theory of charges in non-homogeneous dielectrics. Experiment shows that the electrostatic flux density produced in any dielectric when placed in an electrostatic field is directly proportional to the resultant field intensity and, except in the special case of certain kinds of crystals, the direction of the electrostatic flux density coincides with the direction of the field intensity. The ratio of the electrostatic flux density to the field intensity is called the dielectric constant of the dielectric. That is, calling $4\pi D^3$, the electrostatic flux density at any point in the dielectric, and H the resultant electrostatic intensity at this point, the dielectric constant of the dielectric at this point is

$$K = 4\pi D/H \dots\dots\dots (1)$$

The dielectric constant is thus shown to be exactly analogous to magnetic permeability.

Now the surface integral of the displacement, D , is equal to the quantity of electricity or the charge, Q_0 , in c.g.s. units.

$$D = \delta Q_0 / \delta A \dots\dots\dots (2)$$

And the integral of the gradient or the field intensity, H , is equal to the potential difference. That is,

$$E = \int_0^s \delta H = sH \dots\dots\dots (3)$$

Consider, then, any number of flat plates separated by sheets of dielectric of varying thickness.

Let: s_1 be the thickness in cms. of the first sheet.
 s_2 be the thickness in cms. of the second sheet.
 $\dots\dots\dots$
 s_n be the thickness in cms. of the n-th sheet.

Let: k_1 be the dielectric constant of the first sheet.
 k_2 be the dielectric constant of the second sheet.
 $\dots\dots\dots$
 k_n be the dielectric constant of the n-th sheet.

Let: Q be the charge per unit area. Then by equation (2): $Q = D$.

By equation (1) we may write:

$$\left. \begin{aligned} H_1 &= 4\pi D/k_1 = 4\pi Q/k_1 \\ H_2 &= 4\pi Q/k_2 \\ \dots\dots\dots \\ H_n &= 4\pi Q/k_n \end{aligned} \right\} \dots\dots\dots (4)$$

Combining equations (3) and (4) we may express the potential drop across each sheet:

$$\left. \begin{aligned} e_1 &= s_1 H_1 = s_1 4\pi Q/k_1 \\ e_2 &= s_2 H_2 = s_2 4\pi Q/k_2 \\ \dots\dots\dots \\ e_n &= s_n H_n = s_n 4\pi Q/k_n \end{aligned} \right\} \dots\dots\dots (5)$$

³ For an explanation of the presence of the factor 4π , see Maxwell: Electricity and Magnetism, Vol. 1. "D" is the term which Maxwell has named the "Displacement."

If E is the total voltage drop across m sheets we may indicate equations (5) by the summation:

$$E = 4\pi Q \sum_1^m s^n/k^n \dots\dots\dots (6)$$

The resultant capacity of the combination of plates and dielectrics, C , expressed in electrostatic units per unit area is:

$$C = Q/E$$

$$= \frac{1}{4\pi (s_1/k_1 + s_2/k_2 + \dots + s^n/k^n)} \dots\dots\dots (7)$$

But by equation (5),

$$Q = e^n k^n / 4\pi s^n \dots\dots\dots (8)$$

Substituting this value of Q in equation (7) and applying equation (3), we may write at once the general expression for the electric gradient in any sheet:

$$H^n = e^n/s^n = \frac{E}{k^n (s_1/k_1 + s_2/k_2 + \dots + s^n/k^n)} \dots\dots\dots (9)$$

Referring now to the diagram, we have an impedance bridge of the usual type arranged for the comparison of two capacities. If the bridge is excited by means of a sine wave alternator of, say 500 cycles and 200 volts and the ratio of the resistance arms R_1 and R_2 or the capacity C_1 is varied for a position of minimum sound in the telephone receiver, the condition obtains:

$$R_1 C_1 = R_2 C_2 \dots\dots\dots (10)$$

Let: s_0 be the initial spacing of the plates of C_2 .

k_0 be the dielectric constant of air, = 1.0000.

k be the dielectric constant to be determined.

s be the thickness in cms. of the dielectric sheet.

A be the area in sq. cms. of the dielectric sheet.

C_a be the capacity of C_2 in air for an area A .

C_a^1 be the capacity of C_2 with composite dielectric for an area A .

Then by equation (7):

$$C_a^1 = \frac{A}{4\pi \left[\frac{s}{k} + \frac{(s_0 - s)}{k_0} \right]} \dots\dots\dots (11)$$

Let the change in C_2 occasioned by the introduction of the dielectric under examination be ΔC_2 , expressed in electrostatic units. Then:

$$\Delta C_2 = C_a^1 - C_a$$

$$= \frac{A}{4\pi} \left\{ \frac{1}{\frac{s}{k} + \frac{(s_0 - s)}{k_0}} - \frac{1}{s_0} \right\} \dots\dots\dots (12)$$

Solving for the dielectric constant,

$$k = \frac{4\pi s}{\frac{A}{\Delta C_2 + \frac{A}{4\pi s_0}} - 4\pi(s_0 - s)} \dots\dots\dots (13)$$

Now ΔC_2 is known in terms of the resistance ratio R_1/R_2 and the change in C_1 , ΔC_1 , by the relation

$$\Delta C_2 = \frac{R_1}{R_2} \Delta C_1 \dots\dots\dots (14)$$

Hence to determine k it is only necessary to:

1. Measure the thickness and area of the dielectric under test,
2. Measure the distance between the plates of C_2 ,
3. Know the ratio of R_1 to R_2 , in any units,
4. Have a calibrated variable capacity, C_1 .

The variable condenser may be calibrated in any one of the standard ways, such as by comparison with a standard condenser, by the use of a ballistic galvanometer, etc.⁴ If a variable air condenser with a graduated scale is used it is convenient to plot a calibration curve of degrees deflection against microfarads.

In the construction of C_2 no special precautions need be taken beyond those which readily suggest themselves. If s_0 is an adjustable distance a considerable range of values of dielectric constant may be determined with a single small calibrated variable condenser. All errors due to edge effects are avoided by constructing the plates of C_2 considerably larger than the sheet of dielectric under measurement. For other methods of exciting the impedance bridge and for indicating the balanced condition, such as the use of storage cells and a commutator, vibration galvanometer, etc., reference should be made to any standard text on electrical measurements.

If there is available an alternator of 200 cycles or more, with approximate sine wave characteristics, the use of a telephone for indicating the balanced relation in the impedance bridge will be found very satisfactory.

An illustrative example may be given to show the ease of computation. Let it be required to find the dielectric constant of a plate of composite glass the thickness, s , of which is .16 cms. and the area, A , is 300 sq. cms. Let R_1 be 300 ohms and R_2 be 1800 ohms. and the distance s_0 between the plates of C_2 is set at .40 cms. It is found that a deflection of 40 deg. in the the bridge after the introduction of the dielectric in C_2 . From the curve of calibration.

$$\Delta C_1 = 40^\circ = 0.00020 \text{ microfarads.}$$

By equation (14)

$$\Delta C_2 = 0.00020 \times 9 \times 10^5 \times 300/1800. \\ = 30. \text{ electrostatic units.}$$

Substituting in equation (13)

$$k = \frac{4\pi \times .16}{\frac{300}{30 + \frac{300}{4\pi \times .40}} - 4\pi \times .24} \\ = 6.06.$$

Assuming that the distances s and s_0 can be measured to within one-tenth of a millimeter, the accuracy of the determination depends upon the degree of precision in the calibration of the condenser. It will be noted that ΔC_2 enters in equation (13) as an additive term to $A/4\pi s_0$. Hence if the area is chosen reasonably large and the value of k is near unity,—such as the constant of india rubber, for example—a five per cent error in the value of ΔC_2 may introduce less than one per cent error in the final determination of the dielectric constant.

⁴ See J. Henderson: Practical Electricity and Magnetism, Chap. V. A variable condenser can be constructed whose capacity may be calculated from its dimensions.

THE NEWEST AND LARGEST GIANT GOLD DREDGE.

Electricity still continues to play the leading role in the design and evolution of the modern gold dredge.

Yuba No. 16 at Hammonton, Cal., is destined to be the largest gold dredge in the world. Its hull was launched on the 26th of November. The 900 tons of steel slid into its inland pond on schedule time just six weeks after the first steel was laid.

The dredge will be completed and operating in February. Like its immediate predecessor Yuba No. 15, described at some length in our issue of Nov. 11, 1916, it is all of steel and equipped with an endless chain of 100 two-piece manganese steel buckets, each holding 18 cubic feet of gravel and electrically operated throughout. It will dig 82 ft. below the level of the water in which it floats, and will have an installed motor capacity of over a thousand horsepower.

Yuba No. 16 is unique in that it will be used for making a channel or the flood waters of the Yuba River. Two stackers at each corner of the stern will stack the waste far to the side. Thus the dredge will recover the gold, form a channel and build the levees to confine it—all at one operation.

Costing close to half a million dollars Yuba No. 16 will pay for itself in a year and a half. For the other ten or fifteen years of its life it will earn a profit of a thousand dollars a day for its owners. It will excavate 10,000 cubic yards of gravel per day extract the infinitesimal amount of gold, and stack the waste—at a cost of little over three cents per cubic yard. This Yuba dredge is operated by a crew of only three men.

As an instance of the increasing cost of material, the advance in the actual market value of steel used in this dredge is interesting. Since the steel for its construction was ordered, the cost of this product has advanced to such an extent that the dredge has an increased intrinsic value of sixty thousand dollars from this source alone.

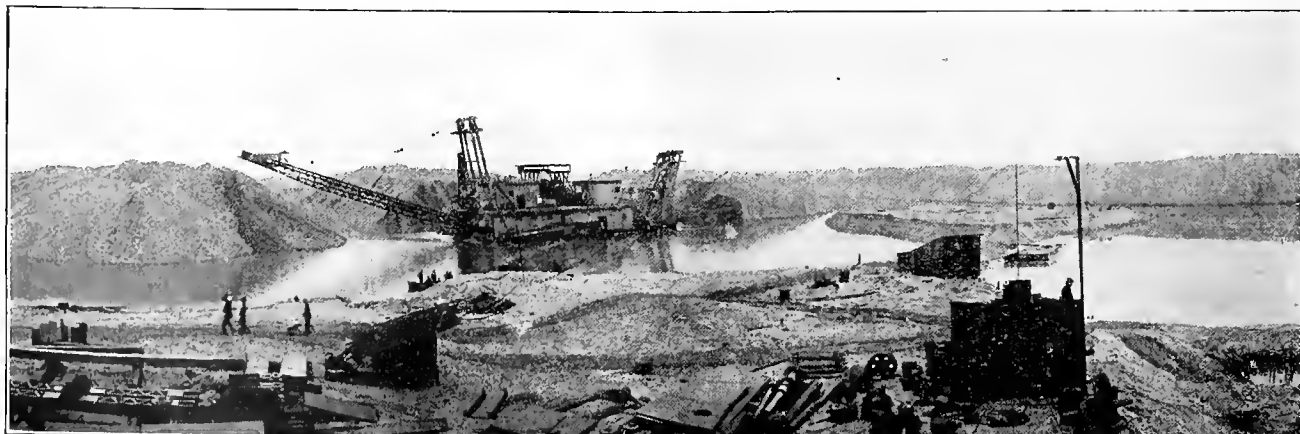
The increased uses of electrical energy for the operation of gold dredges is of especial interest to hydroelectric companies of the West. California design is practically setting the standard for the gold dredge the world over.

LINKING-UP ELECTRIC POWER STATIONS.

A discussion in a recent issue of *The Electrical Review of London* concerning the difficulties of interconnecting various power companies is of interest to our readers. Some briefs from this discussion appear in the following lines:

It is now pretty well agreed by everyone who has taken the trouble to investigate the matter, that material benefits are to be derived from linking-up electricity supply stations; but while there has been some progress in this direction, a great deal remains to be done before the full advantages of the scheme are realized. The difficulties involved in interconnecting the London electricity supplies are much more formidable than daily newspaper writers seem to imagine, for their idea, apparently, is that it is simply a question of joining together a few cables or wires, when a thoroughly reliable supply of electricity for London will be assured. Unfortunately, however, the problem is much more difficult. Had it been realized in the early days of the electrical industry that the coupling-up of electrical systems would, in time to come, lead to marked economy, as well as greater reliability and a reduction in the total amount of plant, it is more than likely that greater uniformity in voltages and frequencies would have been aimed at. As it is, stations have been erected with frequencies ranging from 25 to 100 cycles per second, and there is also considerable diversity in voltage. Even the frequencies of some of the larger and more recent stations which might advantageously be interconnected are not by any means in conformity.

In America, where coupling-up has been practiced on a much greater scale than it has been here, very similar conditions prevail. The frequencies of the American stations are 25, 33, 40, 50 and 60 cycles. In the past there were 125 and 133-cycle stations, but these have now practically disappeared. The two frequencies most commonly used at the present time are 25 and 60 cycles, and there appears to be no very logical reason why any other values should be adopted in future. It is claimed that modern rotary converters will work quite well on 60-cycle circuits, so that there is no need to adopt 40 or 50 cycles on this score.



The Largest Electrically Operated Gold Dredge—The New

So far as America is concerned, there appears to be a distinct tendency to adhere in future to 60 and 25 cycles, and to eliminate other frequencies as occasions arise. To link-up American systems many frequency changers have been built, and when similar work is seriously commenced in this country there will undoubtedly be a big demand for these machines. Having equipped our stations with complete disregard to the possibility of linking-up, we are in the unhappy position of having stations working at 25, 33, 40, 50, 60, 83, 85, 90 and 100 cycles per second. Moreover, there are many different voltages, and some stations supply single-phase current, a few two-phase current, and the bulk of the large and most modern stations three-phase current. There are also, of course, some three-wire continuous-current stations which may eventually be converted into substations and fed from larger plants, or be interconnected with them, as in the case of other stations.

When larger power systems are interconnected, the possibility of very heavy currents flowing in the mains at times of short circuits must be kept in view. The use of current-limiting reactances demands, under these conditions, very careful consideration, especially when the stations contain large turbo-alternators. When the stations are at a considerable distance apart, the transmission lines or cables interconnecting them provide a certain amount of protection; in fact, in the case of some of the large interconnected waterpower schemes, nothing beyond the transmission lines has been necessary to keep the short-circuit currents within permissible limits, for the lines act in a similar way to reactances connected between sections of station bus-bars. But it is to be remembered that many of these waterpower stations contain large low-speed generators with comparatively low short-circuit currents. Much depends on the sizes and characteristics of the plants and the distances between stations. On some of the interconnected systems in America, current-limiting reactances are used pretty extensively and there is little doubt that as the capacities of stations in this country increase, and as one by one they are interconnected, this practice of using reactance coils in generator leads, between sections of station bus-bars, and in feeder circuits, will become more general than it has been hitherto.

NOTES ON MUNICIPAL ENGINEERING PROBLEMS.

R. H. Thompson, a noted consulting engineer of Seattle, Wash., made an address recently before the Reed College extension department and the Portland Realty Board on "Engineering Problems of City Development."

Mr. Thompson was city engineer of Seattle and managed the expenditure of more than \$40,000,000 for civic improvements. He said in part:

In 1765 a tinker in Glasgow got the idea that the expansion of steam would move a piston. Then after 23 years of personal saving and labor he brought forth the first steam engine in 1788. At this date the dawning of a new age came. This was followed by Fulton with the steamboat and Stephenson with the locomotive. With this new age came concentration of population into cities and the city fathers had new obligations placed upon them.

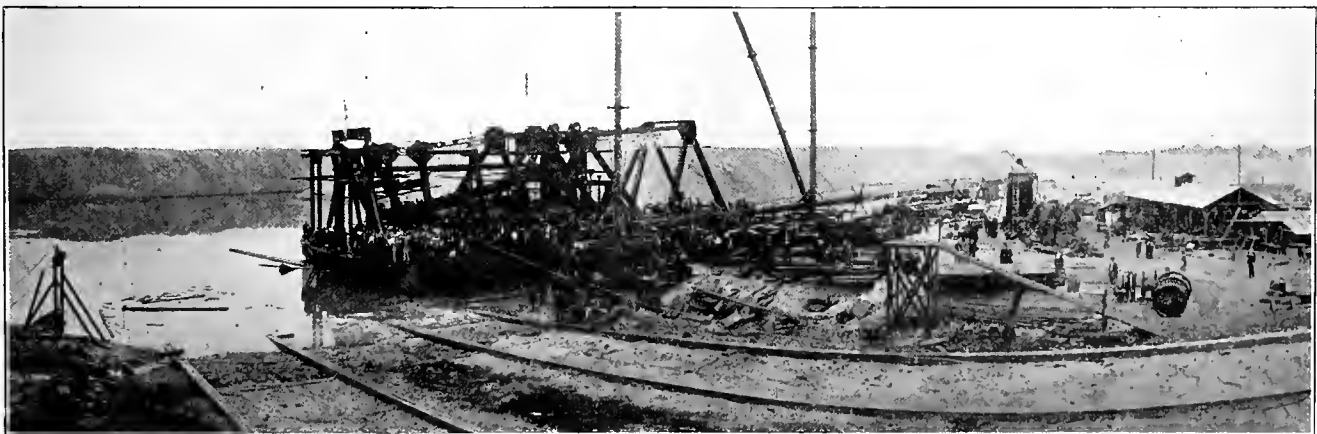
After 2000 years London had a population of 700,000, one hundred years afterwards it had increased to 5,000,000 due to the effects of steam.

Every public improvement has been fought. Nothing has ever been done by cities in sanitary lines until the death rate became alarmingly high. Even Berlin had no sewers until 1888. The death rate in Russia today without sanitation is 6 out of every 10 infants.

Public improvements are always fought, because it will increase taxes. But gradually the public began to realize the meaning of "no man liveth alone and no man dieth alone," and municipalities began to bring water into the cities, put in sewers, pave and clean streets and establish places of recreation as man became unable to do the necessary labor for existence, since disease began to carry them off.

Ben Franklin seems to have the honor of causing the first street light to be installed. He had a friend who had a bad mud hole in front of his house and he induced him to hang a lantern over it.

It is absolutely necessary for the development of productive industry to have the proper avenues of communication to carry them out. A city depends upon its "Hinter Land" and ease with which communication is made between it and the city. Time is the controlling element and bad roads and steep grades cause a great waste of time.



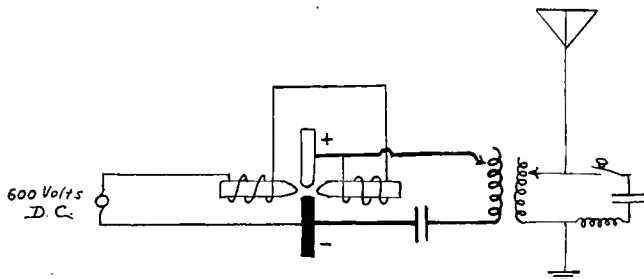
Yuba No. 16 Under Construction in the Gold Dredging Fields of California.

THE SINUSOIDAL WAVE METHOD OF RADIO TELEGRAPHY.

BY WALTER HAYNES.

A second general class of transmitters employ undampt or sinusoidal ether waves for transmitting signals. It is customary in this type of transmission to permanently connect (either conductively or inductively) the high frequency alternating current generator to the antenna and to form code by diverting the antenna current to an absorbing circuit for such period as it is desired to discontinue radiation.

The most interesting feature of undampt equipment is the high frequency generator. The first was the oscillating arc which was discovered by Tesla and Duddell and later improved by V. Poulsen. The wiring



The Wiring Diagram for the High Frequency Generator.

ing diagram for this generator is given in illustration. The + and — electrodes of the arc are water cooled copper and carbon respectively. The supply current is passed through an electromagnet winding which is so constructed and situated that an intense magnet field is maintained in the vicinity of the arc. A further refinement consists of an atmosphere of hydrogen surrounding the arc. Both the magnetic field and the hydrogen envelope accelerate the oscillations and enable the arc generator to operate at radio frequencies.

Many attempts have been made to produce high frequency alternators embodying the principles of ordinary electro-magnetic induction. To reach radio frequencies requires either, an excessively large number of poles, enormous speeds, or a compromise between these extremes. Alexanderson's 100,000 cycle, 2, 1 kw., 20,000 r.p.m. alternator is the most successful of this type of machine to appear, and it is far from practical for commercial work.

R. Goldschmidt has developed an alternator possessing a very unique basic principle. Starting with a direct current stator, L , as shown in the Goldschmidt diagram, is excited while a rotor revolving N revolutions per second has induced within it a current of N cycles per second. A tuned circuit, L_1, C_1, C_2, L_2 , presents virtually no impedance for this frequency, hence the corresponding current is large and by reaction on the stator sets up a current of frequency $2N$ therein. Now the circuit L, C, L_3, C_3 , is tuned for maximum admittance for this frequency whence the current is limited only by the resistance of the circuit. The fluxes resulting from this current together with the speed of the rotor sets up a current of frequency $3N$ in the circuit L_4, C_1, C_4 , which is also tuned for maximum current at the frequency $3N$. Similarly this current induces a current of frequency $4N$, in the circuit

L, C, A, G . Since all circuits of this generator are "tuned circuits" it is highly important that the rotor speed be maintained constant at a set value.

Generators of this type are in daily use on trans-Atlantic service and are reported highly satisfactory.

The use of vacuum bulbs for producing high frequency oscillations is now most promising. Several types are now in process of development while some may be considered fairly perfected. As is well known, long distance radio-telephony was so perfected a year ago, that by its use, the human voice was transmitted from Arlington, Va., to San Francisco, Cal., with all desired degrees of success, and understandable even in Honolulu. The exact type of bulb used has, to date, not been made public.

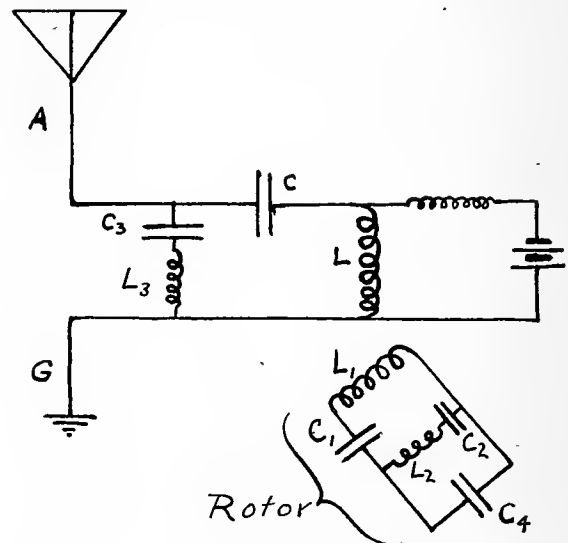


Diagram of Connections for the Goldschmidt Alternator.

A most remarkable bulb which may be used for receiving and amplifying as well as producing undampt oscillations, has been developed by Prof. Geo. W. Pierce.

This bulb utilizes a pencil of cathode rays which is suppressed by a reverse e.m.f. to a critical value but which will operate on the addition of a very small triggering e.m.f. This bulb was recently used in Cambridge, Mass., for detecting and recording messages originating in Germany, upon a tape. So well did it operate that in three hours' receiving not a word was lost, except for a few minutes while a high power station was working nearby. The modus operandi of this tube and to a certain extent, all tubes, is not yet fully understood.

Perhaps the latest developments along radio transmitting lines are given to perfecting a source of direct currents of high potential. Three general types will be mentioned in as much as they point out items of possible future interest.

Mercury arc rectifier tubes.

Rectification by means of electromic discharge of heated metals in vacuo.

Rectification by means of a commutator.

The first two methods rectify single-phase currents, while the third operates on a nine-phase current. Direct current of 100,000 volts potential have been produced by these means.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Cleanliness is a new factor injected into illumination fixtures. The up-turned bowl used in modern indirect lighting systems is highly efficient only when scrupulously kept clean.

* * *

Central station managers in many sections of the West still continue to exert every influence in the promotion of appliance sales and the net result is proving highly satisfactory.

* * *

A carload of Maine lobsters have been shipped West and are today starting life anew in the waters of Puget Sound. It seems as if any form of life can get rejuvenated west of the Rockies—even the lobster.

* * *

Russian grammars have arrived on the campus of the University of Washington from London. This is another indication of Western awakening to engineering and commercial opportunities in countries bordering the Pacific.

* * *

Pyrometer tubes or tubes for ascertaining high temperatures are being designed and supervised in manufacture by the United States Bureau of Standards. They are said to be equal in quality to the refractory porcelain formerly obtained at Berlin.

* * *

Even the banking houses are to be awakened to the possibility of electrical display lighting of their windows. Eminent authorities argue that proper display of banking methods in window spaces would promote the banking habit.

* * *

As to whether special peak operating and installation expenses pay for the outlay is being seriously called into question. The publicity is of high value in many instances, such for instance as ball games and the like, but the ultimate return small.

* * *

"How-I-Did-It" is a little series of short snappy prize stories that is being published by the Westinghouse Lamp Company. The stories are purely educative in value and are meeting with the hearty commendation of electric sales forces from all quarters.

* * *

The electrical motograph is becoming a powerful sales medium for department store advertising. In Chicago a brilliant line of moving words descriptive of the goods for sale within is tantalizingly made to play over the entrance of one of her huge department stores.

* * *

The frightful accident in Boston heralded in Western papers on election day, in which a large number of street car passengers were drowned, has caused the mayor of that city to call a noted conference to discuss the subject of safeguarding drawbridges in the future.

In the case of resuscitating a person suffering from an electric shock authorities agree that the work should be carried on without the slightest intermission for anywhere from an hour and a half to two hours, or until there is unmistakable signs of the final passing of the victim.

* * *

The safety first movement with its beneficial results is forcefully set forth in Illinois statistics where the number of accidental deaths by railways and electric lines has been during the past year reduced by two hundred eighty-six and the number of persons injured by fourteen hundred eighty-nine.

* * *

The city of Dayton has made a civil engineer its city manager. An eastern technical editor propounds the question, "Why should not county engineers become county managers?" The query is a pertinent one and well within the bounds of the expanding possibilities of the immediate future of the engineer.

* * *

A Chinese who has invented a typewriter for his native language has obtained a patent from his government to run for five years. This typewriter uses four thousand Chinese characters. The usual Chinese printing press uses six thousand characters. This new invention should vastly forward commerce and engineering in the Orient.

* * *

From a compilation of figures by "The Automobile," it is learned that California ranks fifth in the use of motor cars and trucks. The state is second per capita in the use of automobiles, having one machine for each fifteen people. The record is only exceeded by Iowa, with one machine to each thirteen people, while New York has only one machine to every thirty-nine inhabitants.

* * *

The last act of a show that has made a world's record by two years' run is now being prepared at the Panama-California International Exposition at San Diego. Because the last day of 1916 falls on Sunday, Exposition officials have chosen New Year's Day for ringing down the curtain. The last weeks of the Exposition are filled with events of great interest and the aim of the directors to make the final month the best of the two years appears to be realized.

* * *

"If the war is to keep up considerably longer, the United States will own the world," was a remark made a day or two ago by the most conservative banking authorities. "We are taking the accumulated wealth of the Entente Powers and paying for it with American labor and American products at monumental prices. We are sending wheat at \$1.50 per bushel, with the prospects of \$2 in the near future; other grain prices, while not as proportionately high, are nevertheless very profitable."

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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The intricacy of the fabled Gordian knot was simplicity itself as compared with the tangled web of finance and politics involved in the Los Angeles aqueduct power situation. The boldness and directness of the means employed to end the difficulty put the great Alexander to shame by their summariness. The municipality would not sell its power to the power companies in the field, the power companies and the city did not relish the idea of a long siege, and so the two power companies merged their systems in order that the city could purchase them.

This is the solution which waits but the approval of the California Railroad Commission, as regards the merger of the Southern California Edison Company and the Pacific Light & Power Corporation, and of the people of Los Angeles, as regards the assumption of a further bonded indebtedness of twelve million dollars. Precedent would indicate the acquiescence of the commission and of the people. The proposed merger will facilitate large savings in operation, make for greater efficiency, and insure continuity of service. The people have already voted ten million dollars in power bonds for properties which can be more economically operated by a further expenditure of twelve million to acquire the distribution systems serving two-thirds of the city.

To be sure, the Los Angeles Gas & Electric Company is already serving the remaining third and will undoubtedly get its share of the other business when competing with the municipally owned system. But a fair share of the twelve million dollars might later be applied to the purchase of this system, with its steam plants, instead of the city's building more hydroelectric plants.

It is evident that a majority of the people of Los Angeles desire municipal ownership of their electric light and power service, even though the taxes are already close to three per cent. While wise economists point out the folly of such political operation, there is no gainsaying the fact that it is preferable to cut-throat competition and duplication of investment. Furthermore, the city need not go to the expense of constructing steam plants to insure continuity of service.

Any contract whereby the power companies will supply current to the city will undoubtedly give a smaller return on the investment than has been the case in the past. This reduction in income, however, will be compensated by greater immediate stability of investment with the possibility of greater extensions in supplying industrial needs. The next ten years, under such an arrangement, should witness new construction of both hydroelectric and steam plants to care for the increasing needs of this prospering territory.

The proposed solution represents mutual concession. At this stage of the negotiations no one can

safely predict the outcome. But certainly both the contracting parties are to be congratulated upon the evidence of a spirit of compromise in a case where a deadlock threatened dire consequences. The outcome will be watched with interest throughout the country, particularly by the people of Central California, who will face much the same problem when Hetch Hetchy power is developed.

The thrilling performance of radio telegraphy of recent occurrence, wherein a message of greeting from the President of the United States to the Mikado of Japan was made to circle half the globe, brings to a climax a story of remarkable achievement that has a moral to it for all workers in the field of electrical activity.

A Little Story With a moral

Here it is:

Michael Faraday was a poor boy in England. He felt he had it in him to become a great man. So he started out performing experiments with certain pieces of electrical apparatus. He was earnest and painstaking and though possessed of little mathematical knowledge he compiled research data that are today authorities along certain lines of investigation, in spite of the fact that a century has nearly passed since his time.

After Faraday's experimental research data became known to the world an eminent mathematical physicist, Maxwell by name, grouped together Faraday's work in such a manner that, although Faraday had never established experimentally the existence of radio ether waves, still Maxwell was able to establish the profound conclusion from mathematical deduction alone that radio ether waves did as a matter of fact exist.

After Maxwell's time came a brilliant young German investigator, Hertz by name, who carried Faraday's ground work and Maxwell's deduction to such further limits that he was able to send these waves experimentally across his laboratory.

Later came Marconi and put to practical application the laboratory experiments of Hertz. And finally within the past month other investigators have carried the work to further limits. Even the Mighty Pacific has been spanned by radio ether waves with a single relay at the Hawaiian Islands.

This story which reads like romance has a profound application in modern business endeavor. In this instance it is seen that the brilliant achievement of the month would never have been possible without the successive coordination and carrying forward of human intelligence by master minds.

The man today who thinks that he alone can unlock the great possibilities of business endeavor by means of his own self-centered ideas has a long road to travel. What could Maxwell have done without the groundwork of Faraday, or Marconi and later investigators without the convincing experiments of Hertz?

The moral to this story is self-evident. Success today is built upon the foundation laid by a thousand

master minds working side by side. To safely advance forward in utilizing the truths brought to light hour by hour in present day industry, the practical application of one word is necessary—cooperation.

America's Electrical Week has set the pace, let all during the new year harvest the fruits incident to co-operation by even still more fervent endeavor.

In the issue of the Journal for November 11, 1916, editorial comment was made upon the founding of a Bureau of Municipal Research in San Francisco. At that time it was pointed out that such an enterprise was not only to be welcomed in municipal activity, but similar work should extend at once to cover activities of the entire state.

A problem of immediate and pressing importance that may well be referred to a bureau of research has been forcefully brought to light in reviewing the bitter controversy of Southern California between the power companies supplying the city of Los Angeles and the locally owned municipal supply. Recent advices indicate that an adjustment of this problem is not as near at hand as might be desired.

A second striking instance of such problems is that of the Hetch Hetchy and its possible unbalancing of the present power distribution in Central California.

Sooner or later one or the other of the parties to this issue are going to be woefully disappointed in the readjustment of power distribution after the advent of this supply in the markets of the state.

There is only one truth to be known about this problem and a bureau of research, properly constituted, is the practical means by which the public may ascertain the plain, bare facts and formulate a proposal for amicable adjustment of its various ramifications.

As to how this board may be constituted some may differ as to details, but when men really agree that it is the plain, ungarnished truth that is desired, stripped of political or private bias, this detail sinks into insignificance.

This state has at its command engineers and other citizens of world-wide note for fairness and integrity, who could properly dispose of these matters in short order, provided all agreed that only the plain facts were desired to be known.

Such a commission—say composed of five men, possibly an engineer, a lawyer, an agriculturist, a banker and a business man—serving without salary—could review the findings of the research board and then propose a solution that would unquestionably meet public acceptance on all sides.

The financial issues ahead in this state and other commonwealths of the West are of vast proportions. To properly finance these projects there must be unbounded confidence among the public at large.

It is high time, then, that state-wide research be used to ascertain the proper relationship of all the factors that enter into these issues, which are of such gigantic magnitude.

A State-Wide Opportunity for Research

PERSONALS

John B. Miller, president of the Southern California Edison Company, is at New York City.

Tully R. Cornick, contracting engineer from Seattle, is a recent business visitor at San Francisco.

J. C. Hobrecht, electrical contractor of Sacramento, was a recent business visitor at San Francisco.

H. J. Snow, Marshfield Electric Company, Marshfield, Ore., was a recent business visitor at San Francisco.

W. E. Hayes, of the Hayes-Van Fleet Electric Company of Santa Rosa, was a recent visitor at San Francisco.

H. A. Lemmen, commercial manager Reno Power, Light & Water Company, was at San Francisco during the past week.

Ross B. Mateer, commercial agent for the Southern Sierras Power Company, was at Los Angeles last week from Riverside.

R. B. Searight, with the Allis-Chalmers Company of San Francisco, is making an extended trip throughout Northern California.

T. W. Simpson, vice-president Federal Sign System (Electric), is making a ten days' trip throughout the San Joaquin Valley and Southern California.

T. E. Bibbins, president of the Pacific States Electric Company, is expected to return from a short business trip throughout the East about the 20th of the month.

E. M. Florence, district manager of the Pacific Gas & Electric Company, at Redwood City, recently gave an annual dinner for the employes of that company in his district.

F. H. Gasaway, owner and manufacturer of the Universal Curb Lighting System of Oakland, has recently closed a contract to supply the city of Los Angeles with these curb lights.

E. Kramer, electric range salesman for the Westinghouse Electric & Manufacturing Company, who has been in charge of the company's exhibit at the Stockton show, has returned to San Francisco.

W. R. Lyall, representative of the D. & W. Fuse Company of San Francisco, who is now campaigning throughout Texas, sends his best regards to the electrical fraternity on the Coast.

R. G. Kendrick, formerly manager of the Kendrick Electric Company of Seattle, is a recent business visitor at San Francisco, and is contemplating opening a new jobbing house in the Northwest.

John A. Britton, general manager of the Pacific Gas & Electric Company, who has for the past three weeks been recovering from an operation for appendicitis, has resumed his duties at his office.

W. S. Van Winkle has been elected chairman of the Great Western Power Company, Bay Section, of the National Electric Light Association, R. H. Sharon, vice-chairman, and J. K. Fairchild, secretary-treasurer.

Earl Fisher of the commercial department of the Pacific Gas & Electric Company, has made extensive arrangements for a big time at the annual jinks held at the Native Sons' Hall, San Francisco, on the 14th for the employes of the P. G. & E.

P. M. Downing, hydroelectric engineer of the Pacific Gas & Electric Company, recently returned from a tour of inspection of the J. H. Wise Power House, South Yuba No. 5, which will be completed and tied into the main system about the first of the year.

Dr. Eiyi Aoyagi, professor of Kyoto Imperial University of Kyoto, Japan, who has been for the past three months traveling throughout Europe and the far East, and has just completed his tour of inspection of the United States on hydroelectric development, expects to leave for Japan shortly.

E. E. Brown was recently elected president of the San Francisco section of the California Association of Electrical Contractors, C. B. Kenny, vice-president; C. L. Chamblin, secretary; D. W. Kohlwey, treasurer, and the members of the executive committee are Geo. Sittman, H. C. Reed and T. Bennett.

MEETING NOTICES.

Joint Luncheon of Portland Sections of N.E.L.A. and A.I.E.E. with the Oregon Society of Engineers.

The fourth bi-weekly luncheon of the Joint Local Sections of the A. I. E. E., N. E. L. A. and the Oregon Society of Engineers was held Wednesday noon, December 6, in the orange room of the Oregon Hotel, Portland, Ore.

A. C. Brill of the Pacific Telephone & Telegraph Company presided as chairman and J. H. Corcoran, division superintendent of traffic for the telephone company spoke on "The Telephone Girl at Her Work." The meeting was under the auspices of the Pacific Telephone & Telegraph Company and had an attendance of fifty-three.

At the luncheon December 20th, Judge C. U. Gantenbein, judge circuit court, department No. 6, Multnomah county, will speak on the "New National Defense Law." The luncheon will be under the auspices of the Oregon Society of Engineers.

Joint Meeting of Portland N. E. L. A. and A. I. E. E. Section

The regular monthly meeting of the Joint Local Sections of the N. E. L. A. and A. I. E. E. was held in the Auditorium of the Y. M. C. A. Building, Portland, Oregon, Tuesday evening, December 5th. W. E. Montrose of the Pacific Telephone & Telegraph Company read a paper on the "Construction of Outside Telephone Exchanges." This paper will be published in full at a later date.

The discussion was entered into by Messrs. Brill, Pollock, Whitmore, Broili, Weber, New and Prebstell.

It was announced that on January 9th W. J. Davis, Jr., Pacific Coast engineer for the General Electric Company, will present a paper on the application of "Steam Turbines with Reduction Gearing to Ship Propulsion." This will be illustrated by lantern slides and moving pictures.

The March meeting will be an address by Prof. Morgan of Reed College, who will talk on the "New Chemical Element Electricity."

The discussion of Mr. Montrose's paper brought out that in Oregon alone there is \$200,000 to \$500,000 expended annually for outside exchanges and also that all wire has been standardized for outside work to No. 12 B. & S. gage hard drawn copper and No. 8 B. W. G. steel wire. For the sleet conditions around Portland the telephone company is now installing extra heavy construction.

Jovian Rejuvenation at Los Angeles.

An especially successful rejuvenation of the Jovian Order was conducted at the Elks' Club, Los Angeles, on December 8th by Tribune Harry N. Sessions. This success was contributed to by the large class of candidates, sixty-one in all, the fine dinner and entertainment preceding the rejuvenation and the excellent rendition of the ritual. Great credit is due Tribune Sessions for his great energy in personally securing members during a three weeks' whirlwind campaign preceding the rejuvenation. In this work he was ably assisted by Messrs. Peters and Pearson of the Southern California Edison Company.

Nearly two hundred Jovians sat down to the sumptuous repast preceding the rejuvenation. Tribune Sessions was given a tremendous ovation on his arrival as was likewise Toastmaster A. E. Morphy. Some startling features in the musical and dancing program of entertainment added greatly to the hilarity of the occasion. Brief remarks were made by Ira J. Francis, the father of the electrical business in Los

Angeles, Ernest Ingle for the candidates, G. B. McLean of the Pacific Light & Power Corporation and B. F. Pearson of the Southern California Edison Company.

After dinner the crowd adjourned to the lodge room where sixty-one electrical members were duly initiated into the mysteries of Jovianism. The degree team was as follows:

E. L. Lewis, Jupiter.	Imps—
Ralph Clapp, Neptune.	J. G. Monahan,
C. E. Cayot, Vulcan.	E. B. Clay,
Z. H. Sherart, Pluto.	T. C. Carr,
C. L. Spring, Mars.	G. T. Kirkpatrick,
J. M. Morris, Apollo.	F. G. Lasher,
H. H. Fogwell, Hercules.	J. S. Addis.
F. B. Nightingale, Avrenim.	

The following candidates were initiated:

Armstrong, Clarence M., The Megerberg Co.
 Aylesworth, Robt. Dyer, Aylesworth Electric Co.
 Anderson, Frank Edward, Pacific Light & Power Corp.
 Bishop, Gilbert Haven, Southern California Edison Co.
 Booth, Willis H., Hotpoint Electric Heating Co.
 Baruch, Milton, Llewellyn Iron Works.
 Buttress, Howard P., Buttress & McClellan.
 Brody, Harvey Allen, Southern California Edison Co.
 Barton, Geo. Sydney, Baker-Joslyn Co.
 Connell, John Francis, Contractor.
 Carruthers, Raymond I., Southern California Edison Co.
 Cates, Richard Herbert, Southern California Edison Co.
 Ducker, Peter H., Southern California Edison Co.
 Davis, Fred H., Southern California Edison Co.
 Decker, George Edward, Southern California Edison Co.
 Dielman, John Henry, Weinstock-Nichols Co.
 Decker, Charles William.
 Farnham, Charles, Pacific Electric Mfg. Co.
 Frampton, Wm. Rex, Southern California Edison Co.
 Graef, Wm. P., Pacific Light & Power Corporation.
 Holabird, Russell G., R. D. Holabird Co.
 Holabird, Harry G., R. D. Holabird Co.
 Herb, Rudolph Carl, Pacific States Electric Co.
 Harmer, Clarence Joseph, Pacific Light & Power Corporation.
 Harris, Ford W., Graham & Harris.
 Ingold, Ernest, Electric Equipment Co.
 Jones, Fred C., Southern California Edison Co.
 Jordan, Wm. Francis, Southern California Edison Co.
 Kelley, Arthur R., Valuation Engineer.
 Lecklider, Ira Henry, Pacific Light & Power Corporation.
 Littell, H. M., Southern California Edison Co.
 Martin, Jonas Lewis, Los Angeles Electric Supply Co.
 Minner, Philip S., Southern California Edison Co.
 McCullough, Wm. J., Southern California Edison Co.
 McWhorter, Chas. Leonard, Philadelphia Storage Battery Co.
 McElwain, Roy Leighton, Southern California Edison Co.
 McFadden, Robt. Clyde, Pacific Light & Power Corporation.
 Nittinger, Vernon Edward, Fairbanks-Morse Co.
 Pearce, Robt. W., Southern California Edison Co.
 Percival, F. H., Southern California Edison Co.
 Patterson, Jas. Benjamin, Pacific Sales Corporation.
 Pendleton, Chas. Howard, Pacific Sales Corporation.
 Raffo, Frank H., Automatic Refrigeration Co.
 Reynolds, Del Mar, Pacific Electric Railway Co.
 Spring, Harry Edward, W. D. Dunham.
 Stanton, Joseph, Southern California Edison Co.
 Summers, Harry B., Westinghouse Electric Mfg. Co.
 Trott, D. M., Southern California Edison Co.
 Todd, Edward W.
 Toon, Jack, F. E. Newberry Electric Co.
 Trickey, Lawrence Leslie, Southern California Edison Co.
 Van den heuvel, Wm., Consulting Engineer.
 Waldron, Richard, Jr., Board Fire Underwriters.
 Weber, Wm. Edward, Pacific States Electric Co.
 Westgate, Chas. Adam, Listenwaller & Gough.
 Wright, Gilbert Sol., Wright-Callender Andrews Co.
 Weller, Lloyd Elwyn, Listenwaller & Gough.
 Wescott Earl C., Pacific Sales Corporation.
 Lockwood, Robt., Southern California Edison Co.
 A. B. Miller, President Fontana Power Co.

ENGINEERS MONUMENTAL FLOOD-LIGHTING INSTALLATIONS.

The illumination of the Statue of Liberty on a scale commensurate with its importance as America's most famous monument may be regarded as the climax of three years of effort and development in the art of flood-lighting.

Until the advent of the gas-filled mazda lamp about three years ago, flood-lighting was seldom indulged in, being regarded as too much of a luxury for permanent use, even by wealthy building owners.

In the rapid progress of flood-lighting since 1914, which has included the illumination of the Woolworth Tower, New York City, the Panama-Pacific Exposition and now the Statue of Liberty, not to mention scores of smaller though locally important installations, no individual has played a more useful part than a certain modest young engineer of Cleveland, H. Herbert Magdeick. Mr. Magedick was graduated from the University of Wisconsin in the class of 1910, and since then has been connected with the engineering department of the National Lamp Works.

MOTOR GENERATOR SETS FOR KEY ROUTE.

In last week's issue of the Journal it was stated that the Great Western Power Company had installed new turbine generators in their Key Route power house. This should have been three motor generator sets, developing 11,000 volts synchronously.

NEW C-H MACHINE TOOL STARTING AND REGULATING CONTROLLER,

In addition to its new automatic type machine tool controllers The Cutler-Hammer Mfg. Co. of Milwaukee has developed a new compact type of drum controller made in



New Type C-H Machine Tool Controller.

standard sizes of 1 to 25 horsepower. These controllers provide speed regulation by inserting resistance in the shunt field circuit, the armature resistance being designed for starting duty only. The maximum speed range that can be provided is 3 to 1.

BOOK REVIEW.

Engineering of Power Plants. By Robert H. Fernald, M.E., A.M., Ph.D. and George A. Orrok, M.E. Size: 6 in. by 9 in.; 586 pp.; 309 illustrations; cloth binding. Published by McGraw-Hill Book Company of New York City, and for sale by Technical Book Shop, San Francisco. Price \$4.00.

The notes from which this book has been compiled have been used for several years in two prominent engineering institutions as a fundamental course in power plants for all senior engineering students, including mechanical, electrical, chemical, civil and mining engineers.

The fundamental points insisted upon throughout are such that the student is brought to a realization of the fact that engineering, although based on exact sciences, is not itself an exact science, hence "common sense" must often displace theory in practical application. The second aim is to give the student some idea of the commercial side of engineering.

The book covers a very broad field in its discussions which are listed in twenty-six separate chapters. The commercial aspects of the steam engine and steam turbine and the internal combustion engine are well handled. Under the treatment of fuels, coal receives a thorough consideration. Fuel oil, however, is not treated to the full extent that engineers of the Pacific Coast should desire. The chapter devoted to hydraulic power is brought down to the last word and is of high practical value. Taken as a whole the work should find a welcome place among that class of books that serve the engine in getting a grasp of power plant engineering as a whole.

NEWS NOTES

FINANCIAL.

LOS ANGELES, CAL.—The comparative income account for the year ended October 30, and for the month of October of the Mt. Whitney Power & Electric Company is as follows:

	1915.	1916.
Gross revenue	\$637,275	\$690,905
Operation, maintenance and taxes.....	265,640	289,197
Total net earnings	371,634	401,708
Bond interest	134,589	164,284
Balance	237,045	237,424
Net, times bond interest, 2.4.		
Month of October—		
Gross revenue	\$72,354	\$69,582
Operation, maintenance and taxes.....	37,006	23,864
Total net earnings	35,348	45,717
Bond interest	14,935	17,645
Balance	20,413	28,072
Net earnings, times bond interest, 2.6		

OLYMPIA, WASH.—The net income of the Olympia (Wash.) Light & Power Company for the year just ended was \$35,748.21. The street cars earned \$1,755.33 of this amount and \$33,992.88 was earned by the auxiliary system. Gross earnings totaled \$74,325.31. Improvements made to the property of the company increased its value from \$518,916.75 last year to \$522,616.57. Stock of the concern is placed at \$165,000, bonded indebtedness \$90,000, and the liabilities \$51,821.24. The Tumwater plant is valued at \$128,469.75, and the power plant lands at \$65,364.15. The company paid a dividend of 3 per cent in February and 2.5 per cent in August.

LOS ANGELES, CAL.—Pacific Light & Power Corporation, excluding interest on \$2,338,000 six per cent collateral trust gold notes, paid directly by the Southern California Gas Company and any revenue derived from that company, reports gross earnings for October, 1916, of \$270,382, as compared with \$256,522 for October, 1915, a gain of \$13,860, or 5.40 per cent. Operating expenses, maintenance, and taxes at the same time increased \$9511, leaving net earnings of \$171,775, as compared with \$167,426 for October of the preceding year, a gain of \$4349, or 2.60 per cent. A decrease in other income of \$3765 gave a total income for the month of \$176,848, as compared with \$176,265 for October, 1915, a gain of \$583. Interest charges for the month amounted to \$100,759, as compared with \$106,645 for the corresponding month of the previous year, a decrease of \$5886, or 5.52 per cent, leaving a balance of \$76,088, as against \$69,620 for October, 1915, a gain of \$6468, or 9.20 per cent. For the ten months ended October 31, 1916, gross earnings of the corporation amounted to \$2,703,012, as compared with \$2,417,657 for the corresponding period of 1915, an increase of \$285,355, or 11.80 per cent. At the same time operating expenses, maintenance and taxes for the ten months' period increased \$110,848, or 13.76 per cent, leaving net earnings of \$1,786,752, as compared with \$1,612,245 for the 1915 period, a gain of \$174,507, or 10.82 per cent.

ILLUMINATION.

MERCED, CAL.—The city trustees have ordered the placing of electroliers on Court House avenue.

PORTLAND, ORE.—The city auditor has been authorized to advertise for bids for lighting the streets and municipal buildings of the city.

CHICO, CAL.—The new electrolier lighting system, plans of which were drawn by Martin C. Polk, are being considered by the city trustees.

SAN LEANDRO, CAL.—The town board has unanimously decided that the electroliers installed in connection with the new electric lighting system should be marbelite.

SANTA BARBARA, CAL.—The city council has instructed the city engineer to prepare plans and specifications for metal standards for the lighting system on State street.

MERCED, CAL.—The plans for the new ornamental lighting system, which were drawn by Charles T. Phillips, of San Francisco, have been approved by the city trustees.

EUREKA, CAL.—The Eureka Electric Lighting Company has applied for an electric lighting franchise in this city, the application being accompanied by a petition from certain taxpayers.

SEATTLE, WASH.—The Seattle & Rainier Valley Railway Company will build a single track line on Genesee street from Rainier avenue to Fiftieth avenue South. The cost will approximate \$100,000.

ORANGE, CAL.—The board of supervisors has directed the clerk of the board to advertise for the sale of the franchise applied for by the San Diego Consolidated Gas & Electric Company, bids to be opened January 3, 1917.

LOS ANGELES, CAL.—Notice of the sale of a franchise for the gas pipe lines under the application of the Southern California Gas Company, has been referred to the county counsel for revision by the board of supervisors.

LOS ANGELES, CAL.—The installation of electric work in the new Los Angeles County Hospital buildings will be done by the Southern California Electric Company, the contract having been awarded to that company for \$33,720.

LOS ANGELES, CAL.—It is reported by the Athens Improvement Association that an election for the formation of the Athens Lighting District has been carried. The city is now drafting notices of intention for the city's share of the work.

CLE ELUM, WASH.—The bonds authorized by the city of South Cle Elum at the special election held some time ago to prepare for a municipally owned lighting plant were sold to the state of Washington at par (\$5000) to draw interest at 5¼ per cent.

LOS ANGELES, CAL.—Steps looking toward the condemnation before the State Railroad Commission of the gas plant of the Los Angeles Gas & Electric Corporation, that the city may establish a municipally owned and operated gas plant, have been authorized by the Mayor.

SAN BERNARDINO, CAL.—C. W. Hickock of Riverside, chairman of the joint committee appointed from the valley cities to further the movement to obtain natural gas, has called a meeting at which plans to promote the proposition will be discussed and future action decided upon.

EUREKA, CAL.—A new street lighting system for the city of Eureka, proposed by Manager Jackman of the Western States Gas & Electric Company, is meeting with the approval of business men and merchants. Negotiations are now in progress with the city officials to bring about its installation.

LOS ANGELES, CAL.—J. L. Wilson has been awarded by the board of public works the contract for installing ornamental posts and appliances for the lighting of West Adams street between Grand avenue and Figueroa street, on a bid of \$3565. Proceedings are to be started for ornamental lighting of Genesee avenue between Sunset Boulevard and Fountain avenue.

TELEPHONE AND TELEGRAPH.

WINNEMUCCA, NEV.—The Golends Telephone & Power Company has been granted a franchise to extend its lines through Rochester and Lovelock.

SPOKANE, WASH.—Expenditures of \$32,000 in telephone betterments in Spokane and the Inland Empire have been authorized by the head officer in San Francisco.

RIVERSIDE, CAL.—An improvement association is being formed by Riverside people who have cabins near Strawberry Peak in the San Bernardino Mountains. It is proposed to install telephone lines.

LORDSBURG, N. M.—There has been granted to the Mountain States Telephone & Telegraph Company the right to construct, operate and maintain a telephone line along the south side of Fourth street.

BEND, ORE.—Farmers will organize a new company to be called the Farmers No. 2. to build a telephone line to run south of Pilot Butte and out to the Stanley-Davenport ranch. The Farmers No. 1 line will come in north of Butte and will serve the Grange Hall section.

FABENS, TEXAS.—Fabens is to have its own private telephone exchange. Permission has been granted by the county commissioners to A. E. Smith to erect necessary poles along required right-of-ways. The work to be done under supervision of the county engineer.

CASA GRANDE, ARIZ.—The Mountain States Telephone & Telegraph Company has applied for a franchise to construct, operate and maintain a telephone system and exchange in the town of Casa Grande. The common council has adopted a resolution ordering the question as to whether or not a franchise shall be granted to be submitted at a special election.

SEATTLE, WASH.—Bids will be received by the bureau of yards and docks, Navy Department, Washington, D. C., T. R. Harris, chief of bureau, until December 18th, for a telephone cable connection between the Pacific Coast torpedo station, Keyport, Wash., and the Puget Sound navy yard, also an electric power transmission line from the Olympic Power Company's pole line to the radio building at the Pacific Coast Torpedo Station.

SAN FRANCISCO, CAL.—George de Souza, traffic manager of the Pacific division of the Marconi Wireless Company, announces the appointment of W. A. Winterbottom as division superintendent in charge of the transpacific and Alaska circuits; T. M. Stephens as marine superintendent of this coast and H. Barth, division engineer. These appointments are the result of the resignation of A. H. Graman, general superintendent and George Jessop of the marine department.

TRANSMISSION.

KLAMATH FALLS, ORE.—Kern Bros. Power Company has requested a franchise, and an election will be held on the question.

VANCOUVER, B. C.—The legislature will be asked to sanction the right of the city to own and operate its light and power plant.

SEDRO WOOLLEY, WASH.—The council turned down the new lighting contract submitted by the Pacific Northwest Traction Co.

LOS ANGELES, CAL.—Bids have been asked for by the Board of Public Service Commission for weatherproof copper cables and wire.

TWIN FALLS, IDAHO.—The Elkoro Mines Company has located a waterpower site near Jarbidge, Nev., for the generation of electric power.

CARPINTERIA, CAL.—A special election may be called to vote on the proposition of issuing bonds for the erection of an electric lighting plant.

SEATTLE, WASH.—The commissioners have awarded a contract for additional lighting fixtures to the Cascade Gas & Electric Fixture Company at \$5987.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company will install a power line from Cardiff to the Encinitas Copper Company's mine.

CASHMERE, WASH.—Tentative plans for the construction of a municipal hydroelectric plant was outlined at a recent meeting of citizens and officials.

TULAROSA, ARIZ.—It is proposed to install a water works system here. In connection with the water system an electric light plant will also be installed.

CLE ELUM, WASH.—Bonds for the construction of the municipal lighting plant were sold to the state of Washington at par or \$5000 with interest at 5¼ per cent.

LOS ANGELES, CAL.—R. H. Manahan, city electrician, has submitted to the Board of Public Works a new ordinance governing the installation and alteration of electric wiring.

SEDRO WOOLLEY, WASH.—The first electric steel furnace in the northwestern part of this state is now in operation in the plant of the Skagit Steel & Iron Works of this city.

LOS ANGELES, CAL.—The board of supervisors has awarded a contract to the city of Glendale for the installation of lights and the furnishing of energy for the Verdugo lighting district.

YREKA, CAL.—The California-Oregon Power Company has contracted with the Fruit Growers' Supply Company of this place to furnish power for the latter company's plant at Hilt.

BISBEE, ARIZ.—Electric lights, gas and water mains, will be installed on the new streets being opened up back of Tombstone Canyon, as soon as demand warrants the installation.

ANACORTES, WASH.—To investigate the feasibility of extending light and power lines to Anacortes, A. W. Leonard, president Puget Sound Traction, Light & Power Company, visited here recently.

INDEPENDENCE, CAL.—The Southern Sierras Power Company was the only bidder for the 50-year electric lighting franchise offered for sale this week. The company's bid of \$100 was accepted.

VANCOUVER, B. C.—The legislature will be asked to sanction the city's right to own and operate its light and power plant, in opposition to B. C. Electric Railway Company, or any other company.

HUNTSVILLE, UTAH.—The Petersen Electric Light Company has been organized to sell electric light and power to residents here. The capital is \$100,000. The incorporators are J. L. Petersen and others.

LIBBY, MONT.—An auxiliary power plant, operated by a crude oil engine, costing about \$10,000, entirely separated from present hydroelectric plant, will be installed by the Libby Water Works, Electric Light & Power Company.

WHITE SULPHUR SPRINGS, MONT.—The city council has approved the transfer of the electric franchise to M. Hoover, of Saco, who proposes to take over the plant and make extensions and improvements to the system.

SAN FRANCISCO, CAL.—The Northern California Power Company has applied to the State Railroad Commission for permission to make use of a franchise granted by Yolo County to extend its power line from College City to Dunnigan.

FALLBROOK, CAL.—It is reported here that a light and power line will be run up San Luis Rey to Canfield and Monserrate ranch, and the line may be extended through to Pala, supplying power and light to various ranches en route.

HORNBROOK, CAL.—The Northern California Power Company now has under construction a dam across the Klam-

ath River near this place. Two generators, with a capacity of 12,500 h.p. each, will be installed in the power plant.

SPOKANE, WASH.—The Spokane Heat, Light & Power Company will open salesrooms and offices in the new building on South Post street the first of the year. The present plant is of 10,000 h.p. capacity and will ultimately be extended to 30,000 h.p.

SEATTLE, WASH.—The American Nitrogen Products Company, C. F. Graff, Securities Building, president, are erecting the first unit of a \$500,000 nitrogen plant at La Grande, Wash. The contract for power has been signed with the Tacoma municipal plant.

CASHMERE, WASH.—Arthur Gunn, president of the Wenatchee Valley Gas & Electric Company, has offered to submit to the city council a proposal for furnishing electric service here. It is possible that bonds will be issued for the erection of a municipal electric lighting plant.

KLAMATH FALLS, ORE.—By a vote of 566 to 122 at a special election here recently the voters of Klamath Falls declared in favor of allowing the Keno Power Company of Keno, Cal., to distribute light and power throughout the city in competition with the California-Oregon Power Company.

RITZVILLE, WASH.—Bids are being received by the council of Ritzville, Wm. M. W. Anthony, clerk, for rewiring the light and power circuits at Pump Station No. 1; including the establishment of a marble switchboard equipped with electrical apparatus, according to plans on file with the city clerk.

SEATTLE, WASH.—The construction of a steam electric plant adjoining the site of the existing plant on Lake Union to cost about \$390,000 was assured by the council's passage of the ordinance providing for the extension authorizing a utility bond issue not to exceed \$390,000. The bonds will be issued in denominations of \$100 or \$1000.

SEATTLE, WASH.—The plant of the Electric Heating & Manufacturing Company, makers of Apfels electric insert water heaters, radiators and other appliances, at 1812 Ninth avenue, South, was damaged in a recent fire. Work is to be resumed as rapidly as possible, and aside from the inconvenience no handicap was caused.

POCATELLO, IDAHO.—The Gem Irrigation Company of Owyhee County has asked the State Land Board to authorize a contract between the state of Idaho and the irrigation district for the construction of a \$300,000 power plant at the Arrow Rock Dam for furnishing the Gem district with electricity for pumping purposes. John C. Rice represents the irrigation district.

SAN DIEGO, CAL.—Transmission lines connecting the distribution system at Oceanside, California, has been completed by the San Diego Consolidated Gas & Electric Company and the power plant at Oceanside will be shut down. The regular rates of the San Diego Consolidated Gas & Electric Company materially reduce the cost of electricity for consumers in Oceanside, and are effective as of November 30.

SEATTLE, WASH.—It is reported on good authority that the Great Northern Railway Company is contemplating turning over its water power sites in this state, particularly that at Lake Chelan, to the Montana Power Company, Butte, for development in its electrification plans. The Montana Power Company furnishes the power for the 400 miles of the C. M. & P. S. Railway Company, electric road through Montana. The development of the Chelan site has been estimated to cost \$2,000,000.

SEATTLE, WASH.—The purchase of the Illes Hydroelectric Company of Valdez, Alaska, by the Prince William Sound Water, Power, Light & Telephone Company, a Seattle corporation, for approximately \$100,000, ends a water war

which has disturbed the residents of that district for nearly four years. The Prince William Sound Company, organized in December last, was virtually a consolidation of the old Alaska Water, Light & Telephone Company, and the Valdez Electric Company, the former of which, it is reported, for six years, paid an annual dividend of 12 per cent, and during all of which time it leased its water power from the Illes plant.

TRANSPORTATION.

SAN FRANCISCO, CAL.—By the decision of Judge Sturtevant in giving Mrs. Celia Kahn judgment against E. R. Lienthal for \$5000 as an indorser of the Northern Electric notes, impetus has been given to the efforts for an acceptable reorganization plan. A tentative plan which is being discussed is the reorganization of the concern on the basis of a ratio of five to one between the owners of underlying and overlying securities. With a readjustment of the debts of the several companies it is planned to effect a merger with one of the big electric railroads.

LOS ANGELES, CAL.—Instead of traveling over the old route, the Pasadena Short Line trains and the Oak Knoll trains now travel south only on Main street. The return trips are made along the elevated tracks to San Pedro street, and then North to Aliso street. Trains for Alhambra, Sierra Madre, Sierra Vista are using the westbound loop. These loops are to be used by incoming and outbound trains only during the period it takes to complete the elevated system. When the elevated tracks have been finished they will be used exclusively, and trains will cease running on the busiest downtown streets.

IRRIGATION.

PHOENIX, ARIZ.—The board of supervisors has granted to residents of Queen Creek a distributing right, in order that this community might bond for \$300,000, with which to carry on extensive agricultural improvement work. The money is to be expended for irrigation purposes.

MERCED, CAL.—The Crocker-Huffman Land & Water Company has just completed the seeding of 600 acres beyond Bradley Addition, in the vicinity of Lake Yosemite, to alfalfa. At a cost of \$55 an acre, this work represents the expenditure of \$33,000, and brings up the company's acreage of alfalfa tracts to 3000 acres.

COLUSA, CAL.—The Cheney Slough Irrigation Company has awarded the contract for making improvements on their property to W. C. Blean. Work will proceed at once on the erection of a pump house sufficiently large to accommodate three powerful pumps. To the two big pumps already installed, one 26 in. and another 36 in., will be added still another 26 in. pump.

OAKDALE, CAL.—Work has been started by the South San Joaquin irrigation district in rebuilding what is known as the Hiltz Sag flume, one of the biggest flumes in the state and over 3300 ft. long. The plan is to replace this flume, which carries practically the entire stream of water used for irrigating 70,000 acres, with a concrete structure which, when completed, will cost approximately \$150,000.

FRESNO, CAL.—Extensive irrigation activities are going on about 15 miles southwest of Mendota, and about 45 miles west of Fresno at the mouth of Panoche Creek. On the C. D. Hillman tract a dam is being erected across the bed of the creek, to hold enough water to irrigate several thousand acres. Water is already flowing in the irrigation canal for a tract of 6720 acres. The earth dam is to be only temporary. A site has been located in the foothills for a concrete dam, to conserve all the waters of the Panoche. This dam is to cost \$40,000 to \$50,000, and will store water to irrigate 10,000 to 20,000 acres it is reported.

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Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, DECEMBER 23, 1916

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MULTIPLE ARCH DAMS ON RUSH CREEK.

WIRELESS TELEPHONY.

BY WALTER HAYNES.

ELECTRICITY AT THE BUNKER HILL & SULLIVAN
MINE.

BY WALTER C. CLARK.

PREPARATION OF FOOD FOR ELECTRIC RANGE
COOKING.

BY E. A. WILCOX.

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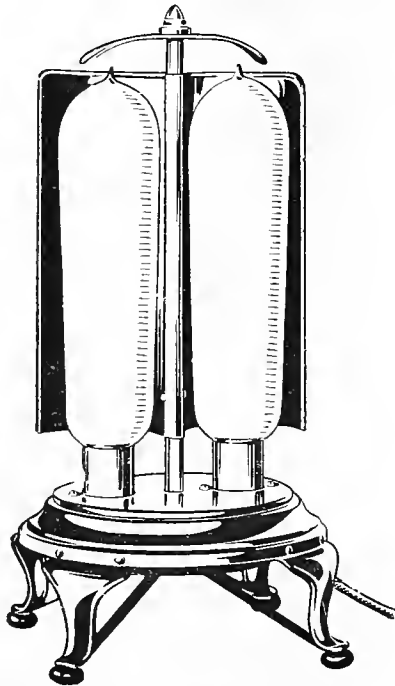
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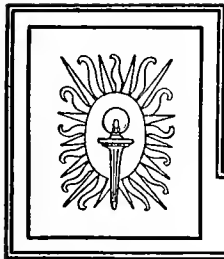
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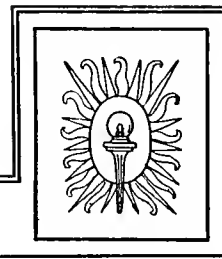
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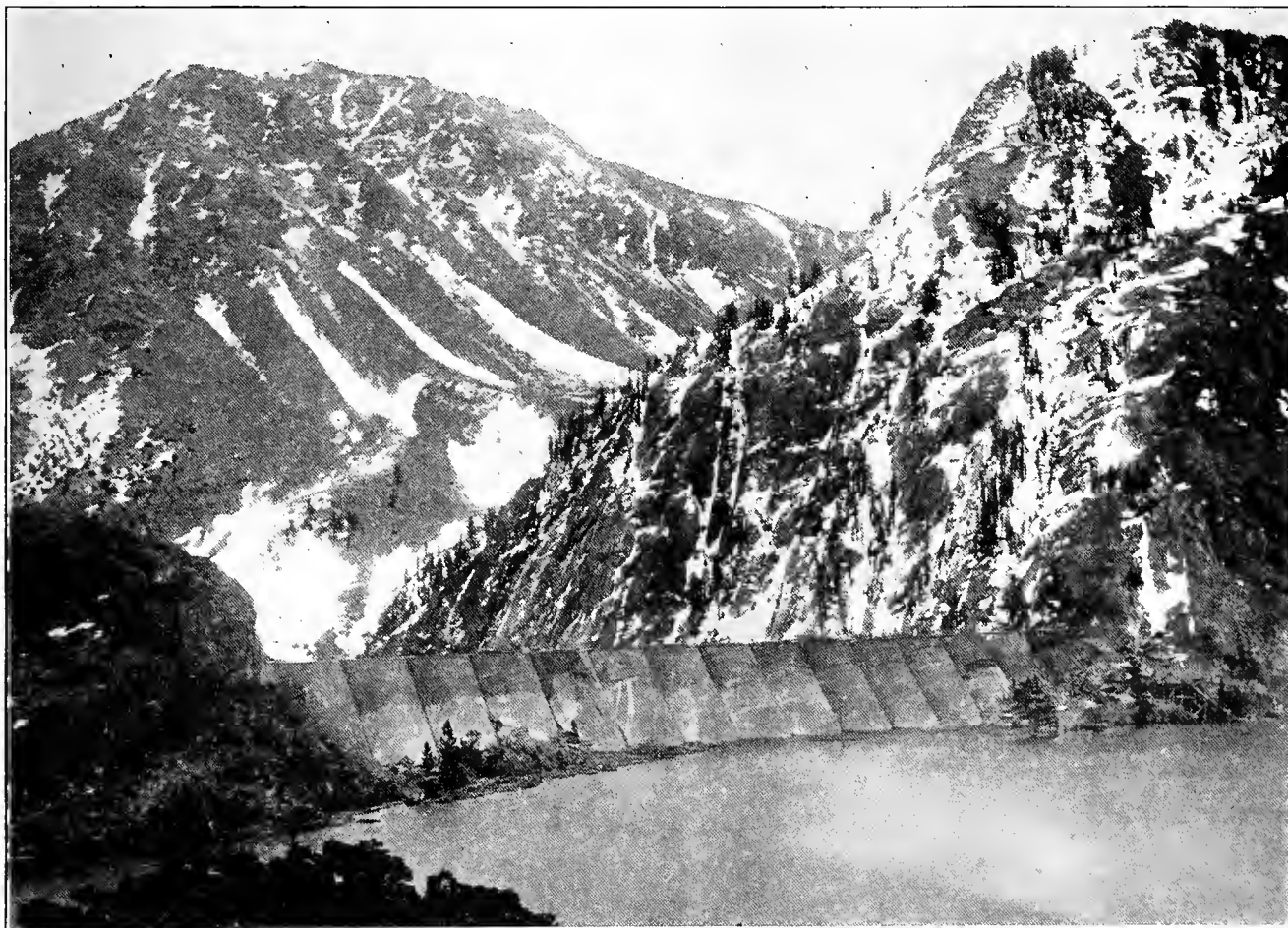
NUMBER 26

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MULTIPLE ARCH DAMS ON RUSH CREEK

In order to more fully develop and utilize the Rush Creek water resources for power and irrigation purposes, it became necessary to construct two storage reservoirs on the upper drainage area. Two natural lakes, Gem and Agnew, already existed, and the own-

tated a dam 84 ft. high, and 700 ft. long at the original lake outlet. The available drainage area is $22\frac{1}{2}$ square miles, and it is estimated that this area will yield an average of 2 second feet per square mile. It is all located between elevations 9,000 and 12,000 ft. above



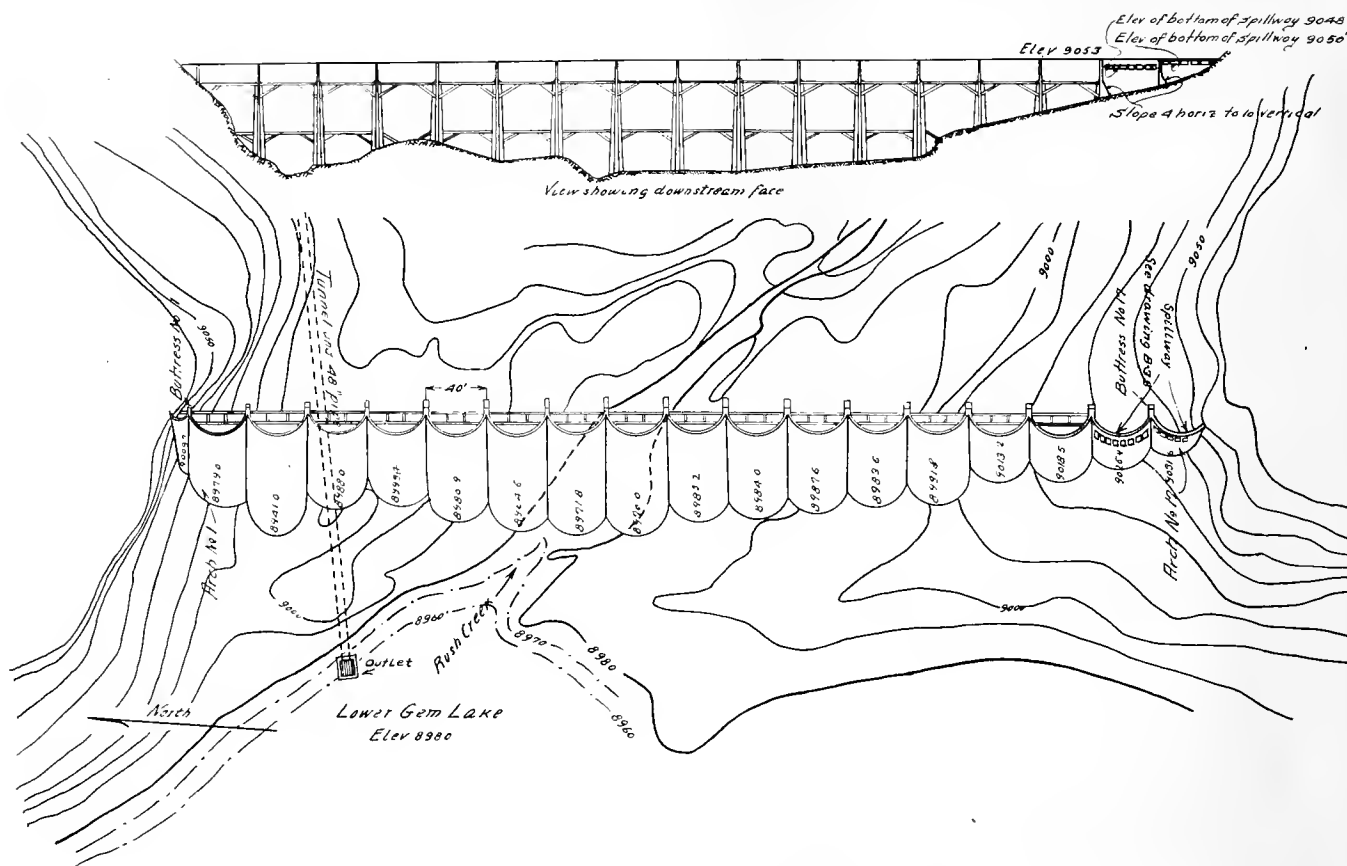
The Gem Lake Dam of the Rush Creek Development.

ers of the water rights, the Pacific Power Corporation, of Bodie, California, decided to develop these two lakes by building dams across their outlets, and to utilize the water in a power house located at Silver Lake, some 1800 ft. (in elevation) below Gem Lake.

To fully equate the stream in an ordinary year, it was found that an artificial storage of 17,000 acre feet would be necessary at Gem Lake. This necessi-

sea level on the eastern slope of the Sierra Nevada Mountains.

This drainage area is covered with a fair growth of pine trees up to elevation 11,000. From these trees the form lumber used in the construction of the two dams was cut to the amount of about one million board feet. The quality of the timber was not the best, but answered the purpose.



Plan of Multiple Arch Dam at the Lower Gem Lake.

For the dams it was decided to use the multiple arch type, or Jorgensen design, and have the two dams nearly alike, except as to size.

The largest of the two dams is the one at Gem Lake, and consists of sixteen full arches and two fractions at the ends. Each arch has a span of 40 ft., making the total distance across the crest approximately 700 ft. The height of this dam is 84 ft. to a point where arch action ceases, but the foundation extends down 112 ft. below the crest elevation (9053) on two arches, across what was apparently an old creek bed. The accompanying plans show the details of the structure. The upstream face of the dam slopes 50 deg. with the horizontal plane, and has the shape of a true cylinder from the bottom up to within 15 ft. from the crest. From elevation 15 to the crest, the shape gradually changes to a typical ellipse, in order that the center line (axis) of the arch may coincide with the center line of pressure, or at least the two be brought very close together.

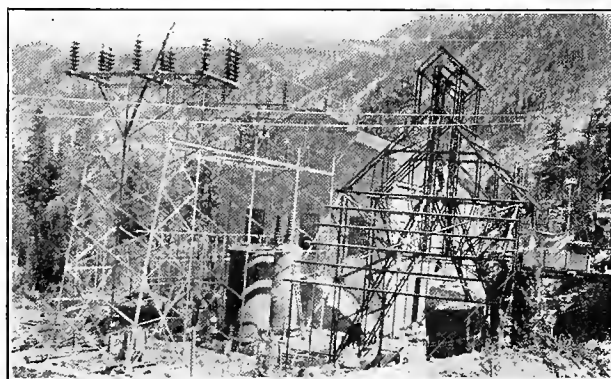
On account of the slope given to the arch for purposes of stability, the load is not uniformly distributed on the arch from the springing line towards the crown, but is greatest at the spring line, due to the fact that any point here is submerged 7 ft. deeper than any corresponding point at the crown. This has a large effect on the stability of the arch towards the crest and necessitates the changing of the shape of the arch from circular to elliptical above elevation 15, or necessitates the making of this portion vertical.

The downstream face of the buttresses is shaped such that the center line of pressure coincides with the center line of the buttresses, at least in the lower portion. In the upper portion the center line of pressure lies upstream relative to the middle line of the buttress to avoid having the buttress appear too slender.

The buttresses are tied together by means of struts as shown on the plans, and are reinforced, although not to any great extent. The arches are more heavily re-

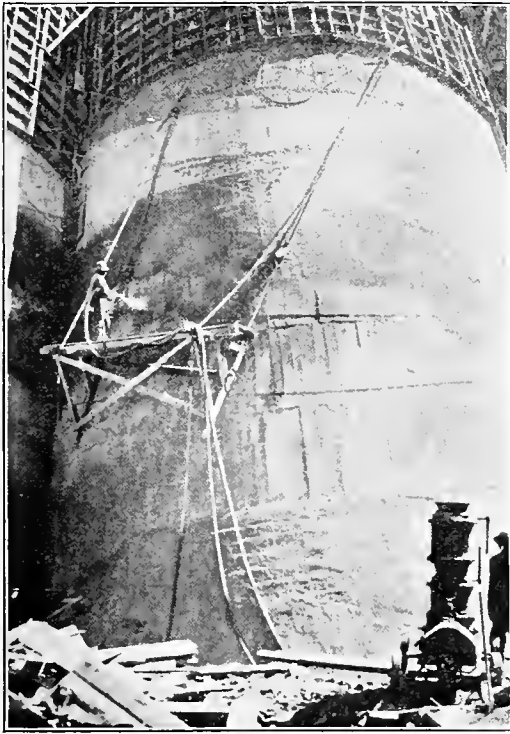


Multiple Arches for the Agnew Dam.



Power Station and Transformer House Under Construction.

inforced, the steel being placed in such a way as to prevent cracks in the concrete when the reservoir is empty in cold weather. For the purpose of watertightness the upstream face was plastered by means of a cement gun. This plaster as put on is $\frac{3}{4}$ in. thick at the bottom, and $\frac{1}{4}$ in. thick at the top. This work,



Cement Gun in Operation on the Arches of the Gem Lake Dam.

however, is not quite completed, as the temperature dropped too low to continue operations until completion this year.

The outlet from the lake is 48 in. diameter pipe laid through a short tunnel underneath the dam. The floor of the tunnel is 20 ft. below the original natural lake level.

The Gem Lake dam contains 8537 cubic yards of concrete. For the buttresses $1\frac{1}{4}$ barrels of cement per yard was used, and for the arches $1\frac{1}{2}$ barrels of cement was used, and for the arches $7\frac{1}{2}$ barrels per yard. Good sand, with about $3\frac{1}{2}$ per cent of clay mixed in it, was found at the lake shore near the mixing plant. Rock was taken from a slide about $\frac{1}{2}$ mile away and hauled on a tramway to the works. This rock was crushed to about 2 in. maximum size, and screened into two sizes in addition to the sand that was formed. These three piles were again mixed with additional lake sand.

A mushy mix, using about 10 per cent of water, was put into the arches where the concrete would have to flow around the reinforcement. For the buttresses concrete of a somewhat dryer consistency was found permissible, and about 9 per cent of water to total weight of aggregate was used for this mix.

The concrete was tested at intervals, and the crushing strength of 8 in. diameter cylinders averaged about 900 pounds per square inch when 14 days old. The tensile strength of mortar briquettes $1:2\frac{1}{2}$ averaged a little less than 200 pounds per square inch when 24

hours old, and 575 pounds per square inch when six months old. In this connection it should be mentioned that the maximum stress in the structure is about 275 pounds per square inch compression with reservoir full to the crest at elevation 9053.

The small dam at Agnew Lake is of similar design, and consists of 7 arches. It has a maximum height of 30 ft. The outlet is a 30 in. pipe through one of the deepest arches, with a slanting grizzly in front. This reservoir is considered as a forebay for taking care of peak loads. It is situated about 550 ft. lower in elevation than Gem Lake, and has a drainage area of $1\frac{5}{8}$ square miles of its own.

The design of the two dams was made by L. Jorgensen of San Francisco, who also acted as construction engineer. C. O. Poole was chief engineer for the whole development. E. J. Waugh was resident engineer, L. B. Curtis, field engineer, and F. O. Wolson, superintendent of construction. Duncanson Harrelson Co of San Francisco were the contractors on the dams.

CALIFORNIA INDUSTRIAL ACCIDENT COMMISSION'S REPORT.

The report of the Industrial Accident Commission of the State of California for the fiscal year ending June 30, 1916, has been published. Accompanying the report is statistical information concerning industrial injuries during 1915, which are divided into three main groups: Deaths, 533; permanent injuries, 1264; temporary injuries, 65,741; total, 67,538.

The commission refers with pardonable pride to the reduction of 158 deaths in the comparison between the figures of 1914 and 1915. In the year first mentioned there were 691 deaths among California's workers, as against 533 last year.^a A similar comparison shows 28 fewer permanent injuries last year than during 1914. There were exactly 5500 more temporary injuries reported last year than during 1914. This is accounted for by the growth of business as the population increases and also by the closer observance of the law requiring the reporting of industrial injuries. The reports cover the three main departments of compensation, insurance and safety.

More and more as time goes on it has been found advantageous to rate permanent injuries on the loss of earning power, based on the nature of injury or disfigurement, the occupation and the age. It was found necessary to make provision for additional injuries and to make the schedule more elastic. There were 549 permanent injuries rated during the first six months of 1916 and in 1915 there were 867 permanent injuries rated.

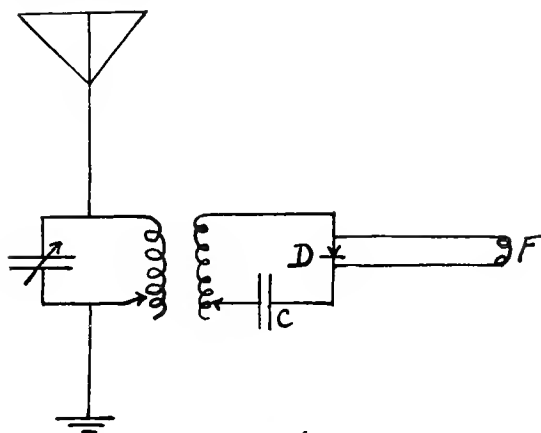
The income of the State Compensation Insurance Fund to June 30, 1916, had reached \$1,837,760.70. The expenditures and reserves amounted to \$1,461,315.35. Refunds to policyholders have been paid to the extent of \$134,381.98, leaving a net surplus of admitted assets over liabilities of \$242,063.37. The dividends declared have amounted to 15 per cent of the premiums earned during the years 1914 and 1915. The total will probably exceed \$170,000 when pay rolls of all insured employers have been ascertained.

WIRELESS TELEPHONY.

BY WALTER HAYNES

Just as radio telegraphy is a specialized branch of electrical engineering, so is radio telephony a sub-branch of radio telegraphy, and as such presents few new problems. Indeed the similarity between the two is almost exactly analogous to ordinary wire telegraphy and telephony. In telegraphy intelligence is transmitted by means of the intermittent passage of a current through the circuit, the periods of current flow and cessation being interpretable into a code having a previously assigned meaning and in telephony intelligence is transmitted by so operating on the electric current that it will in turn cause the air in the vicinity of the receiver to be disturbed approximately proportional to the sound waves used to excite the transmitter.

The nature of sound waves (including voice) is well understood. The frequencies of voice waves vary from about 75 to 2300 complete waves per second, while the upper limit of audible frequency is around 45,000 for the normal human ear.



Connections for Wireless Telephony

We may now enunciate on a priori principle. If, as we have already seen, a current of an inaudibly high frequency can be generated and a transmitter can be found for varying the amplitude of this current, it will be at once possible to pass the modified current into an antenna and thereby radiate a train of ether waves having all the peculiarities imposed upon the original current by the transmitter. (The problem of reconverting the energy of these trains of ether waves to sound waves will be taken up presently).

Two general methods are used in radio telephony for varying the amplitude of the radiated ether waves, namely: Varying the magnitude of the antenna current by means of passing it through a transmitter whose resistance varies with the character of sound waves to be transmitted, or:

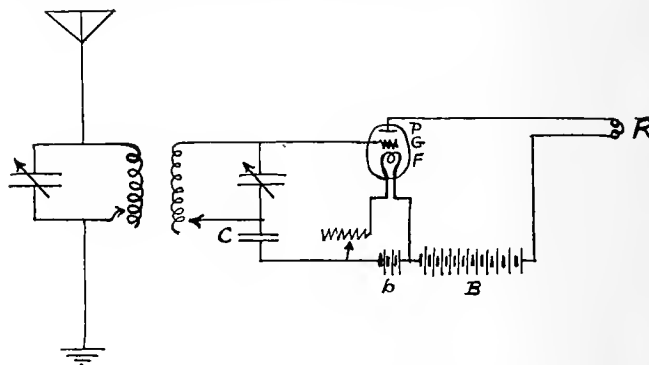
Using the modified current from the transmitter in an auxiliary circuit for triggering off or relaying larger quantities of electrical energy to the antenna.

Almost numberless variations of both these methods, and some entirely unique but commercially worthless schemes besides have been proposed, but a one evening lecture prevents more than passing mention.

The first of the above methods has been used considerably for small powers covering distance up to at least 600 miles. Any high frequency alternating current source may be used to supply the primary energy. The oscillating arc is perhaps most commonly used.

The second method now almost universally uses some sort of vacuum bulb having at least three and usually four electrodes. Oscillating circuits are established between certain of the electrodes and link the antenna and generator together through a section of the bulb that lies between another pair of electrodes. A triggering e.m.f. is set up between these latter electrodes, which, through the agency of its electro-static field partially or wholly diverts the cathode stream from the main circuit anode, thus varying the antenna current and, through it the radiated energy. Excellent results have been gotten with this type of transmitter.

One thing is common to all forms of long wave ether radiation, that is their detection. The earliest practical detector discovered by Branley, consisted of a small quantity of conducting filings so placed as to



A Typical Diagram for a Bull Detector.

bridge a small gap between the antenna and ground. This gap served as a key for operating a local bell or sounder. It had the property of reducing its resistance many hundreds of per cent when acted upon by ether waves, but when once its resistance was reduced, it remained so and the bell rang until it was "decohered" by a jar. Locating the bell clapper where it jarred the coherer while ringing solved the decohering problem, but the coherer was soon discarded because of its lack of sensitiveness.

Magnetic detectors were the first really commercial detector to be developed and used. The principle underlying the working of this detector is that an oscillating current tends to reduce the effectual residual flux in any magnetic circuit around which it is passed. Therefore, any auxiliary coil about the aforesaid flux path will have induced in it an e.m.f. which would produce a click in a telephone receiver connected thereto. The more nearly saturated the steel, the greater would be the variation (or reduction) of flux for a given oscillating current. In order to have a fresh, strong field, Marconi passes an endless steel or iron band past the poles of a magnet just as it enters the coil which carries the antenna current. The magnetic detector, however, lacks sensitiveness, for which reason it has been superseded in late years by various other types.

Several of the most reliable types of detectors, for all around use, depend upon the establishment of thermal e.m.f.'s. between their terminals when currents are passed through them. The usual form employs a mineral crystal rather firmly held in a "crystal cup" of any metal for one terminal while a small wire "cat-whisker, or pointed piece of some other crystal resting lightly thereupon, constitutes the other detector terminal. The simplest detector circuit is shown in Fig 6, where D, C and F denote a detector, a stopping condenser, and a pair of telephone receivers, respectively.

It will be observed that the passage of a train of current waves through D will create a pulse of direct current through the telephones since C opens the path through the inductance. Certain of these mineral crystal detectors are found to be more sensitive if a slight external e.m.f. be applied to them by means of a potentiometer and battery. It seems proper, in passing, to call attention to the electrolytic detector. This detector consists of a platinum wire about 0.003 millimeter in diameter—dipping into a twenty per cent solution of nitric acid in water. In operating, a slight e.m.f. is applied to its terminals. The corrosiveness of the acid and the ease with which a heavy antenna current melts off the platinum wire, have forced this detector into disfavor with operators, but in the laboratory it corresponds to the standard cell, the sensitiveness of all other detectors are rated in terms of the electrolytic.

Several makes of detectors have come into prominent use in late years which embody the rectifying power of an electronic discharge of a hot metal in a high vacuum.

A typical wiring diagram for an ordinary bulb detector is shown in the illustration where R and C are the telephone receivers and stopping condenser respectively, and F, G and P are the hot filament, grid and plate respectively, of the "bulb." A section of the battery, b, is used for heating the filament. Another section B, is so adjusted that the potential between F and P is just insufficient to maintain a constant stream of electrons, or, in other words, an electric current from F to P and through the telephones, F. But the oscillating potential to which b is subjected (when the antenna is excited), is alternately of such sign as to increase the potential of B, and, therefore, cause pulses of current through the receivers. The potential of G between these pulses is of opposite sign (—) which suppresses the electronic migration from F to P, and thus also, the current through F.

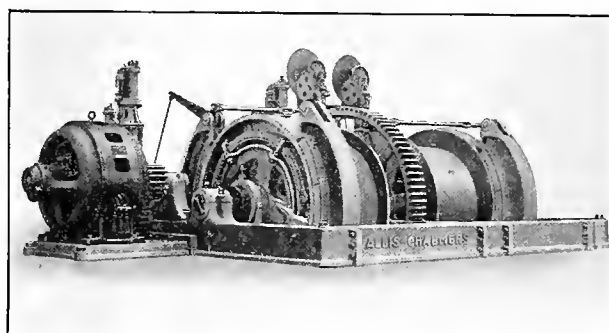
This type of detector is very satisfactory in that it does not "jar out" and hence is unaffected by the rolling of a ship, and withal, it is a very sensitive wave indicator. The most serious drawbacks are its cost, liability to burn out, and the necessity of having to provide so much battery.

Almost numberless types of wave indicators working upon unique and ingenious principles have been invented and all but forgotten in the light of later discoveries. Since no attempt is made here at completeness, only the epoch-making strides have been mentioned.

ELECTRICITY AT THE BUNKER HILL & SULLIVAN.

BY WALTER C. CLARK.

Electricity was first applied to the operations of the Bunker Hill Mine at Kellogg, Idaho, in 1893 when there was installed on No. 3 level an electric hoist operated by a 500 volt d.c. Edison Bi-polar motor supplied with power from a generator of the same type driven by a Pelton water wheel controlled by Woodward governor and butterfly valve. Water for this installation was taken from Milo Creek. This equipment constituted practically all the electrical machinery used in the mining operations until 1897 when the big Kellogg tunnel was started and equipped with a $4\frac{1}{2}$ ton General Electric 500 volt trolley locomotive which is still in operation and giving good service. Direct current for this trolley locomotive was supplied from a General Electric multipolar 500 volt generator driven by a turbine water wheel supplied with water from the South Fork of the Coeur d'Alene River.



The Electric Hoist at the Bunker Hill & Sullivan Mine.

In 1901 the Washington Water Power Company canvassed the district and secured sufficient support to justify building high tension lines into the district to supply electrical energy for mining and milling purposes. In August, 1903, their transmission line from Spokane was put into operation. The first Bunker Hill substation was equipped with one 275 k.v.a transformer.

The present substation is equipped with seven 650 k.v.a. transformers, stepping down from 60,000 volts to 2300 volts for delivery to the Bunker Hill lines.

With the advent of the Washington Water Power Company into this district the extreme flexibility and adaptability of electrical energy became more and more evident. Its popularity is shown by the following table which gives the yearly increase to the Washington Water Power substation at this property:

	Capacities Substation in k.v.a.	Kw.-hr. Used for Year.	Tons Ore Mined for Year.
1903.....	275	288,000	260,900
1904.....	500	915,100	288,232
1905.....	550	1,050,800	304,280
1906.....	600	1,456,000	347,300
1907.....	650	2,470,600	336,230
1908.....	950	2,885,650	335,070
1909.....	1260	4,866,550	345,270
1910.....	1900	6,973,180	377,530
1911.....	1900	7,892,000	432,290
1912.....	1900	7,292,000	434,800
1913.....	3250	8,629,500	435,000
1914.....	3700	9,244,300	440,000
1915.....	4250	10,979,000	455,000

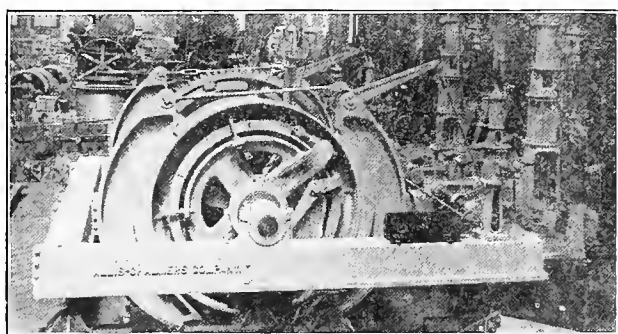
All of the present transformer equipment in this substation is not used by the Bunker Hill Company

as lines have been run to the Stewart mine, to the Pine Creek district, to the Hypotheek, Roanoke and Polaris properties. The application of electricity to the Bunker Hill operations will be treated in the order of the volume used in each department.

Milling.

Milling necessarily constitutes the most important and heaviest load. In the department there are installed 33 motors, having an aggregate of 1897 h.p. in connected load.

In the West Mill No. 1 one 250 h.p. motor is installed to drive the vanner and table floors and one 200 h.p. motor for jigs, rolls, etc. The main motor drives of West Mill No. 2 are practically identical to those of West Mill No. 1. On the floor near the pulley or rope drive is what is called a motor tell-tale or safety device which is installed on our more



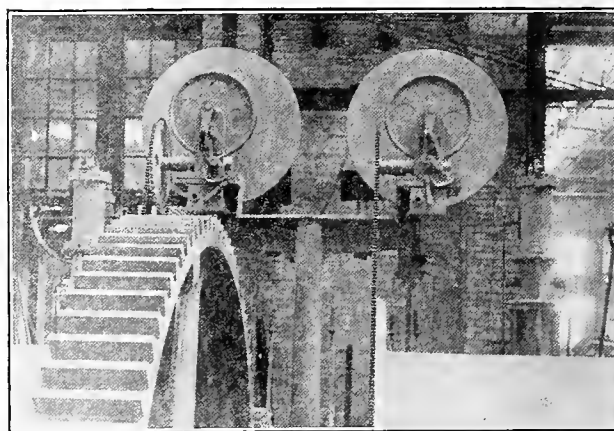
Air Operated Brakes and Clutches with Safety Overwind for Electric Hoist.

important motor drives. This device was invented and patented by M. J. Bottinelli, foreman of the electrical department at the Bunker Hill plant. The bar near the rope has a pivoted stem which in turn engages a cam on the vertical stand. A cord passes around this cam and suspends the heavy carbon contact in the case at the bottom of the stand. If a strand becomes loose it strikes the bar and trips the cam, allowing the carbon contact point to drop into the copper terminals. This connection introduces current into the solenoid attachment on the oil switch of the motor. A tappet is attached to the plunger or armature of the solenoid, and when the current is introduced the plunger with tappet kicks up sharply and throws out the oil switch, stopping the motors.

By thus calling attention to the loose strand before it has unraveled far the strand may be tucked and little time lost; whereas if the rope did not have immediate attention the strands would unravel, possibly wind up in other ropes or equipment and do a great deal of damage. One of the most important duties of the device is its safety first feature used in connection with stopping the motor from some distant point in the plant. Wires are run from the solenoid to different parts of the mill and small knife switches put on the circuit in convenient places. In case of accident on the jig floor, for instance, to a man or machinery the workman can stop the mill by throwing on one of these knife switches, and it is impossible for the operator in the motor room to start up again until the knife switch is again opened. This device is a valuable protection to life, property and lost time.

Rock House.

In the Rock House there is installed over the spillway on the conveyor belt carrying the ore to the crushers a 36 in. 250 volt electro-magnet made by the Electric Controller & Manufacturing Company. This magnet extracts all large pieces of iron or steel before they can enter the crusher. Varied collections of such things as drills, drill bits, hammers, track spikes, monkey wrenches, car links, nails, spectacles and innumerable tobacco cans are collected at this point. The magnet being placed over the pulley at the discharge end of the belt at an angle renders the tractive effort or pull more efficient on account of the broken or loose condition of the ore just at the moment of spilling onto the grizzlies. This magnet saves many dollars



The Overwind Device for the Electric Hoist.

in repairs to crushers, rolls, elevators, etc., by the elimination of all kinds of scrap iron or steel from the mill feed.

Frequently pipemen, mechanics or electricians will lose or accidentally drop tools into the ore pockets underground and can almost invariably get these the next day from the crusher man who finds them on the magnet. Recently a new locomotive pinion was accidentally dropped into the ore pocket and later recovered at the Rock House.

Mine Pumping.

The next and possibly the most important application of electrical energy is in the mine pumping. For this work they have two independent cables carrying 2300 volts strung from the power house to the collar of the shaft about 12,500 ft. distant. Each cable is kept hot or constantly in use either by the mine pumps or hoist. Either one of these cables is sufficient to operate both hoist and pumps, but as a factor of safety the two cables are independently installed. There are five motors installed for mine pumping, having an aggregate connected load rating of 535 h.p.

Each pump circuit is equipped with a General Electric curve drawing ammeter which records in red ink for the full 24 hours, the time of starting, stopping and amount of power used. By the close scrutiny of these charts the careless starting of the motor, the condition of the pump valves, pipe column and other mechanical conditions are revealed.

There are 595,150 gallons of water per day pumped from the shaft at a cost of \$17.12 for electric current only.

Electricity as applied to pumping operations is surely in a class by itself. To attempt to pump this vast amount of water from a shaft over 10,000 ft. from the portal of the tunnel would seem nearly impossible by any other means. The improvements made in the past few years in the design and manufacture of 2300 volt motors, cable and underground electrical appliances is well illustrated by the instance of the flooding of the Bunker Hill shaft some three years ago when a fire started at the collar of the shaft, disabled all the electrical apparatus, causing one of these pump installations to be submerged under 200 ft. of water. The motor submerged was General Electric Form M three-phase 2300 volts. For three weeks this motor remained submerged while the shaft was being pumped out by use of two air pumps lowered into the shaft from the hoist cable. The motor was never removed from the pump and the rotor or armature was not taken out. Electric current at low voltage was applied to its windings—hot air blasts supplied by electric heaters were applied and the fourth day after dewatering the motor and pump was started without a hitch. A performance of this kind certainly speaks well for the manufacturer.

Hoisting.

Electric hoisting constitutes a very important application of electricity.

Our electric hoist, I believe, is the first successfully operated large induction motor hoist in the Coeur d'Alene district. When the Washington Water Power Company began making contracts in the district for power they objected very seriously to large induction motor hoist installations. After submitting to their engineers the details of acceleration and peak load control of the hoist they finally consented to take on the load.

The Cutler-Hammer switchboard controller used in the operation of the hoist is of the multiple solenoid type. There are primary contacts for handling the primary circuit and other contactors controlled by series relays for the control of the secondary circuit of the motor. The acceleration is automatic instead of manual. The engineer opens his controller wide at one stroke and the automatic features of this board control the amount of current taken and time of acceleration. The chart for hoisting operations conveys the same information as those taken on the electric pumping equipment only in a much more elaborate way. This chart travels at the rate of 8 in. per hour under a pen filled with red ink—each of the three strips marked "Morning," "Afternoon" and "Night" has recorded the actual number of times each engineer in charge moved the hoist drum for any purpose whatever. The first chart begins at 8 a. m. and this engineer is on duty until 4 p. m., the others follow, each for 8 hour shifts.

The straight upward mark from the base line indicates the amount of power or amperes applied to start the hoist—the amount of time elapsing before the pen returns to the base line indicates the time the hoist was turning. By this chart record which is made at the power house over 12,000 ft. from the hoist, an absolute check is made on the number of trips per hour or per day, the exact time the hoist moved for men and by careful study it reveals all that the engineer on

each shift is doing, showing the periods of rest and enables the mine superintendent to so arrange all work in connection with the hoisting, to make to maximum efficiency. The charts will also record any accident, unusual condition of motor, track, weight of ore or careless handling by engineers, and as it is made or recorded on the outside of the mine it furnishes a constant report on the tonnage being moved each hour without the necessity of going inside or disturbing the engineer by phone.

During the year 1915 there was hoisted by the main hoist 422,853 tons at an average cost of 1.0473 kw.-hr. per ton or .00589 cents. This electric hoist replaced an air hoist which, however, is still maintained in position and working order on the opposite side of the shaft to be used in case of emergency.

The air for this hoist is reheated by electricity. The valve arrangement on the pipe lines permits of bypassing the heaters when it is necessary to make repairs without unnecessary interruption in hoisting. These heaters require 90 amperes each at 110 volts and are provided with switches which permit of six different heats. Thus the amount of heat required can be given in proportion to the demands of the hoist. This form of compressed air heater has proven very efficient.

Traction.

All ore, timbers and men are moved in and out of the mine by electric locomotives. The ore is first assembled at the shaft pockets by storage battery locomotives, then hoisted to the Kellogg tunnel level by the electric hoist, where it is loaded into larger cars and trams and taken by trolley locomotives to the mills about two miles distant.

Water for the storage batteries is brought into the mine each day in five gallon canvas water bags, the same as those commonly used by prospectors and autoists. The ore assembly trains hauled by the storage battery locomotives average 8 cars per train, each car of 34 cu. ft. capacity or approximately 6000 lb. per car or 24 tons of ore per train. The average distance for storage battery hauling on all levels is approximately 1000 ft.

For charging purposes a motor-generator set consisting of a 50 h.p. three-phase 2200 volt motor connected to a 125 volt d.c. generator is used. This set is located on the 1300 ft. level and supplies battery locomotives on 12, 13 and 14 levels. The motor generator set is provided with circuit breakers and reverse current relays which protect it from overload as well as possible reversal of current due to low voltage or stopping of generator while charging.

After the ore is hoisted to the Kellogg tunnel level it is hauled by 500 volt trolley locomotives to the ore bins. The locomotives used in this work are usually of the 8 ton class and are nearly all of the General Electric make—one being a Jeffrey. The tail light used consists of an A-4 Edison battery and 1½ volt lamp placed in an iron box back of a regulation caboose red lens. This box is provided with hooks to hang over the end of the car. It is placed to one side of the center line to facilitate the coupling and uncoupling of empty timber trucks. The A-4 Edison battery used for these lamps requires charging every 30 days, and extra cells are kept constantly on hand.

The main Kellogg tunnels trains are composed of 17 cars each, each car having a capacity of 46.4 cu. ft., holding approximately $3\frac{3}{4}$ tons per car or 63 tons of ore per train.

Beside the regular train service for the ore hauling, all timbers, mine supplies, coal and wood for the boiler plant is handled by 500 volt trolley locomotives. In all the traction work of the Bunker Hill Company they have over eleven miles of trolley lines and 18 locomotives, representing all makes, with the General Electric predominating.

In the locomotive repair barns provision is made for the rapid disassembling of locomotives for repair purposes.

Block Signal System.

Our block signal system consists of red and green lamps placed every 400 ft. along the tracks underground. The switches for both green and red lamps are located at the end of each block.

The system is manual operated and in no way automatic. Each motorman is responsible for maintaining his own block. On entering the Kellogg tunnel the switch is thrown which lights green lamps every 400 ft. for the full length of the first block or to the side, approximately one mile. The frequency of the green lamps even though the tunnel is full of smoke or steam gives him assurance that he is alone in the block as anyone entering from the opposite end would have put on the red lamps. On leaving the block at the side track he extinguishes the green lights behind him by use of another switch which constitutes the second point of control in this circuit. Each block operates the same way, all locomotives going out light the red lights while those entering the mine light the green ones.

All switches for red or green lamps are indicated by an electric lighted letter or similar color.

The same block signal system applies to the yard trolley system where bells are used in place of colored lamps.

In addition to the block signal system all hoist bells, flashes and telephone signals are operated underground by use of 110 volt a.c. current.

The hoist bells are made up of plain 14 in. gongs equipped with ordinary trip coils, the same as found in the automatic oil switches. This signal system provides a lamp in connection with the hoist circuit so arranged as to light every time the bell strikes. Anyone standing at any station can count the bells given by watching the lamp over the signal switch at that station. When a signal is given the person giving it can be sure the right signal was pulled by watching the lamp flashes at the switch.

All underground telephones are equipped with an auxiliary circuit of 110 volts to operate Russell horns—these horns take the place of bells and the weird sound can be heard far down the drifts or above the noise of pumps, hoists or escaping air.

The Power House.

In the Power House we have two compressors, the first one is a Nordberg with a capacity of 3300 cu. ft.

free air per minute. This machine is not electrically driven. It is driven from a steam engine on one end and a 500 h.p. turbine water wheel on the rope drive over the fly wheel at the other end. The second large compressor has a capacity of 2400 cu. ft. free air per minute. It is made by the Ingersoll Rand Company and is driven by a 400 h.p. induction motor.

A Curtiss steam turbine is installed as an auxiliary plant in case the current supply of the Washington Water Power Company should fail. This turbine is of 750 h.p. capacity and will care for our hoisting, pumping, and traction loads while the water power service may be off. In this connection I will say the service given by the Washington Water Power Company has been most excellent as the interruptions have been very far apart. The turbine is kept in readiness to start on a few moments' notice and can be connected to the main load inside of seven minutes after the power goes off.

Nearly all the switches are of the double throw type so arranged that the circuit it controls can be placed on either the Washington Water Power Company's lines or on the steam turbine.

FUTURE OF AMERICAN ELECTRICAL SUPPLIES IN NORTHERN CHINA AND RUSSIA.

While nearly all articles of metal manufacture showed large reductions, the share of the United States in these imports was commensurate with its increase elsewhere. No separate figures are kept by the customs of the countries of origin of such imports, but the increased display and use of American mechanical and electrical appliances, as well as the certainty that other sources of supply were almost cut off, indicate our real introduction into this market. Throughout the year this consulate had many applications from dealers in the district, from eastern Siberia, and even as far west as Irkutsk and Tomsk, for information as to American manufacturers, freights, and prices. Some of them placed orders directly in the United States, some with the few local agents of American firms, and some with American firms located in Tientsin or Shanghai.

The war in Europe has given to manufacturers in the United States their great opportunity. In spite of the lack of ocean shipping facilities, the difficulties with the railways that feed this market, the inadequacy of present banking and credit methods, and the ruling high prices of American products, American manufacturers have been able to place their goods in this territory. They are making friends with the Russian consumer—and it is not the Chinese trade but the Russian trade which is of chief importance in the immense territory that is destined to draw its requirements from Harbin—and their wares are becoming attractive to him. If this present and initial success is followed up, it need not be from necessity but from choice that the Mongol and the Muscovite may continue their buying from the United States even after the war has finished.

PREPARATION OF FOOD FOR ELECTRIC RANGE COOKING.

BY E. A. WILCOX.

Convenient for the Tenant.—On account of the absence of soot and burned foods, the utensils used on an electric range are easier to cleanse both inside and outside. Silverware in an apartment house never tarnishes as it does where gas is used. Unlike gas, electricity throws off no sulphur fumes.

Another condition that goes to make the electric range popular, is that an auxiliary supply of hot water is usually available for use in the apartment house, and may be utilized for cooking operations to attain quick results.

Desirable Central Station Load.—From an operating standpoint the apartment house business is very desirable for the central station company. The load is, for the most part, of an off-peak character. The load factor and diversity factor are both unusually attractive. The maximum demand is frequently shown to be not over one-sixth of the connected load. Compared with apartment house lighting and elevator loads the business is obviously more desirable.

Knowledge of Cooking Valuable.—For those interested in the sale of electric ranges or in the building up of electric cooking loads, a general understanding of how foods are prepared, why it is necessary to cook them, and the best methods to employ, will be of value. If one endeavors to interest a housewife in an electric range, he should know something about the use to which it is to be applied, otherwise he will not readily gain her confidence. Anyone familiar with the following paragraphs as well as with the natural advantages of electric heat, will be able to show the average housewife wherein electricity is superior to fuel heat in performing the various cooking operations suggested.

Reason for Cooking.—The cooking of food has much to do with its nutritive value. Many articles which are quite unfit for nourishment when raw are nutritious when cooked. It is also a matter of common experience that a well cooked food is wholesome and appetizing, whereas the same material badly cooked may be both unhealthful and unpalatable.

Purposes of Cooking.—There are three chief purposes of cooking. The first is to change the mechanical condition so that the digestive juices can act upon the food more freely. The second is to make it more appetizing by improving the appearance or flavor, or both. Food which is attractive to the taste quickens the flow of saliva and other digestive juices, and thus aids digestion. The third is to kill any disease germs, parasites, or other dangerous organisms it may contain. This is often an important object, and applies to both animal and vegetable foods.

Cooking of Meats.—For the most part meat is either boiled, stewed, fried, broiled or roasted. In general, it is probably true that cooking diminishes the ease of digestion of most meats. It may also remove considerable quantities of the nutrients.

Boiling of Meat.—If it is desired to heat the meat enough to kill bacteria in the inner portions of the cut, the piece must be exposed to the action of heat for a long time. If it is brought slowly to a boil, a

good broth will be obtained, but the meat will be tough and tasteless.

If a piece of meat is plunged into boiling water or very hot fat, the albumen on the entire surface of the meat is quickly coagulated and the crust thus formed resists the dissolving action of water and prevents the escape of the juices and flavoring matters. Thus cooked, the meat will possess the desired meaty taste but the resulting broth will not be considered good.

It is impossible to make a rich broth and have a juicy highly flavored piece of meat at the same time. If the meat alone is to be used, it should be plunged into boiling water and kept at that temperature for about ten minutes, after which the cooking should be continued at about 180 degrees F. until the tissues become tender.

Stewing of Meat.—If both the broth and the meat are to be used, the process of cooking should be quite different from that of boiling. In stewing, the meat should be cut into small pieces so as to present relatively large surface area and, instead of being quickly plunged into hot water, should be put into cold water, in order that the juices and flavoring materials may be dissolved. The temperature should then be slowly raised until it reaches about 180 degrees F. where it should be kept for several hours. Treated in this way the broth will be rich, and the meat tender and juicy.

Roasting of Meat.—The principle difference between roasting and boiling, is in the medium in which the meat is cooked. In boiling the flesh is surrounded by hot water, whereas in roasting it is surrounded by hot air and acted upon to some extent by radiant heat. In both operations, if properly conducted, the meat fibers are cooked in their own juices.

When the meat only is to be eaten, either roasting, broiling, or frying in deep fat is a more rational method than boiling, for the juices are largely conserved in the meat.

Cooking of Vegetables.—Vegetables baked, roasted, fried or boiled, are used for preparing a large variety of dishes. The most common method of cooking is that of boiling in water. The steaming of vegetables is often resorted to, but the results are similar to those of the boiling process.

The simpler the method of cooking and serving vegetables the better. A properly cooked vegetable will be palatable and readily digestible. Poorly cooked, water soaked vegetables generally cause serious digestive disturbances. All vegetables should be thoroughly cooked, but the cooking should stop while the vegetable is yet firm. As long as the vegetable is kept at a temperature above 125 degrees F. changes continue to go on in the vegetable substance. The most marked of these are in the starch, and in the odor, color, and flavor of the vegetable. Overcooking changes and toughens the texture of vegetable foods, destroys the coloring matters, and volatilizes or otherwise injures the substances which contribute to its flavor.

Cooking of Breads and Pastries.—In breads, cakes, pastries and other foods prepared from flour, the aim is to make a palatable and higher porous substance that can be more easily digested than the raw materials could be. Sometimes this is accomplished simply by means of water and heat. The heat changes

part of the water content into steam, which, in trying to escape, forces the particles of dough apart. The protein (gluten) of the flour stiffens about the tiny bubbles thus formed and the mass remains porous even after the steam has escaped. More often, however, other ingredients, such as yeast and baking powder, are used to "raise" the dough. The baking powder gives off carbon dioxide gas, and the yeast causes fermentation in the dough and produces carbon dioxide. This gas acts the same as steam, only much more powerfully.

Baking of Bread.—Bread is placed in the oven as a heavy uniform mass, and comes out a light body of increased volume with a crisp, dark exterior—the crust—and a firm, spongy interior—the crumb. The crumb naturally heats more slowly than the crust. The moisture which it contains prevents its temperature from rising much above the boiling point of water (212 degrees F.) When first put into the oven the yeast begins to work but a temperature of 158 degrees F. kills it. The gas in the dough, however, continues to expand, and forcing its way outward, enlarges the loaf and gives it a spongy appearance. Meanwhile the crust becomes hard and dark and the heat changes its starch into stiff gum and sugar and dries out the moisture. The brown color is due to chemical changes known as "caramelization."

Baking Temperatures.—The heat in the oven should not be too great, or the outside of the bread will harden too quickly, and the crust will be thick and hard before the interior is done. Furthermore, the gas expanding in the crumb will be unable to escape through the crust and will lift up the latter, leaving great holes beneath it.

The temperature of an oven and the time required for baking depends upon the size of the loaves and the character of the dough. Small biscuits or rolls can stand a much hotter oven, and quicker baking, than large bread loaves. For ordinary purposes, a temperature of from 400 degrees to 500 degrees F. is satisfactory for a pound loaf of bread. An experienced cook can tell when an oven has reached the proper heat by inserting his hand, but a pyrometer, (as a thermometer for measuring high temperature is called) makes a much better guide for the ordinary operator.

Demand for Domestic Ranges.—Interest shown in the domestic range is increasing more rapidly than in any other single heating appliance. In line with the attention now being given to this type of apparatus, and the rapidly growing market for it, the manufacturers of heating apparatus are making many improvements in both their original designs, and character of product. A number of concerns which have heretofore confined their activity solely to the production of fuel stoves, have taken up the manufacture of electric ranges. The result of these developments has been a 50 per cent reduction in range prices during the past five years, greater reliability in the heating units, a larger diversity of designs from which choice of equipment can be made, and simpler and more desirable standards of construction.

Essential Qualifications of the Electric Range.—The features of the domestic range which make its use desirable to the customer, the central station, and to those having the marketing of the product in hand, are

generally agreed upon by all who have given the subject their serious consideration. The range, first of all, must be of substantial and durable construction, and of pleasing appearance. The designs must be standardized as rapidly as possible with the economic object in view of lower costs and increasing production. Simplicity of operation and ease of handling and cleaning are also essential. The heating elements must be rugged, reliable and efficient. Furthermore, they should be so designed as to be easily, quickly, and cheaply renewed whenever troubles develop. The ovens must be well insulated with heat resisting material, readily accessible, and easily cleaned. Some provision for broiling, either in the oven or on the cooking surface, is generally considered necessary.

It is of interest to note that the early types of ranges were so designed as to keep down the connected load and the central station demand as much as possible, whereas the present tendency is to neglect this phase of the design in favor of larger capacity units capable of doing quicker work. This is a step in the right direction. The natural diversity of the range load, and the short period demands which it creates are of little moment in comparison with the necessity for greater speed of operation. Furthermore, there is no reason for believing that a range of high rated capacity will consume any more energy in performing its work than one of lower capacity. The efficiency may be approximately the same with either design.

Types of Heating Units.—Heat is usually generated in electric range units by the passage of current through high resistance wires or strips of metallic ribbon. Heating elements in common use may be classified into three different types—first, the enclosed type, second, the radiant type, and third, the reflector type.

Enclosed Type Elements.—These usually consist of a resistance wire or ribbon, enclosed between mica or asbestos strips, or surrounded with an enamel or other electric insulating material of high thermal conductivity. The element is usually enclosed within, bound upon, or otherwise imposed against, a metal disc or grid which takes up the heat, and in turn dissipates it. The heat generated in such a unit is transmitted from the metal surface to the cooking utensil and thence to the food by conduction. When this type of unit is used in an oven, however, the heat is transmitted to the food through the air by convection.

It is obvious that this type of element takes a little longer to start heating than do open elements, because the mass of material of which it is composed has to first absorb a certain quantity of heat before it can begin throwing it off. It is claimed, however, that this type of element will lose less of the heat generated during a longer period of operation than the open coil element. There are certain apparent advantages in having the hot wires hermetically sealed, such as the prevention of oxidation and mechanical injury, but unless the insulating materials are able to withstand extreme temperatures they are liable to serious damage, if the voltage is higher than normal, or if the element is connected for a long period without some means of carrying away the excess heat that is generated. Most enamels melt before they reach a temperature of 1650 degrees F. (Cherry red).

SPARKS—CURRENT FACTS, FIGURES AND FANCY

The Supreme Court of Oregon has ruled that the State Public Service Commission has power to change telephone rates fixed by any city within the commonwealth.

* * *

Artificial rain from artificial clouds is a subject receiving much attention in certain humid states of America. It is said that spray pipes sufficient in number to create artificial rain may be erected at costs averaging one hundred dollars per acre.

* * *

In these very terse words the President advised Congress in his recent message to pass the Webb bill permitting combinations for export trade: "The thing must be done now, because the opportunity is here and may escape us if we hesitate or delay."

* * *

The federal government estimates that the oil lands in Colorado and Utah, which were withdrawn from entry a few days ago for the use of the United States navy, will yield not less than 500,000,000 barrels of fuel oil.

* * *

The prospect in the copper market seems to be according to a well known Boston authority that the next big development in the metal market promises to be the purchase by England and France of another half billion pounds of copper for delivery during the closing six months of 1917.

* * *

Importations of Nicaraguan products by the United States advanced from thirty-one per cent in 1911 to forty-nine per cent in 1914 and to sixty-seven per cent in 1915. The great increase during 1915 was due primarily to shipments of coffee and gold to the United States that formerly went to Europe.

* * *

Nearly a quarter of a million horsepower has made its exit from the United States during the past thirty months. At least reports say that two hundred and twenty thousand horses have been shipped to Europe during this period at a cost of nearly forty million dollars.

* * *

Gold imports in the United States since the beginning of the war have amounted to eight hundred and fifty-eight millions and the exports in that time two hundred and thirty-one millions. It is thus seen that a net importation of nearly two-thirds of a billion dollars is America's strong financial footing today.

* * *

The closing of the Panama Canal from September, 1915, to April, 1916, due to mammoth landslides in the Culebra cut led some people to make doubtful statements as to the ultimate feasibility of the canal. The six months just closed has witnessed, however, a

return to the canal utilization of 98.6 per cent of number of ships experienced in the busiest six months prior to the disaster.

* * *

A tabulation of the one hundred and fifty-eight transits through the Panama Canal in October according to the time required by the ships, shows that eighty-nine of the ships, or more than half, were in the canal between nine and twelve hours. The percentage requiring over twelve hours was 30.7, and the proportion passing through in less than nine hours was 15 per cent.

* * *

Wireless in transmission network operation is becoming a feature that justifies itself as a possible means of transference of needed intelligence at times when telephone and transmission lines are maimed or temporarily put entirely out of commission. A Western hydroelectric company is to be congratulated as being the pioneer in initiating this policy of insurance of continuity of service.

* * *

The final filtering of answers to the question "what is best in engineering education" submitted to members of Tau Beta Pi, the honorary engineering fraternity and digested by Engineering and Contracting, brings out the facts first that extreme specialization should be avoided and, second, that the prime object of a college training should be the formation of good habits of thought that will endure through life.

* * *

Cato and Varro of ancient Rome had knowledge on seeds that is well worth the while for the power salesman to pass on to his electrical pumping client during planting season. Here is what they had to say: "Seed should be examined to ascertain that it is not sterile by age, that it is clean, and, particularly, that it is not adulterated with other varieties of similar appearances. I have seen those seeds on whose selection much time and labor have been spent nevertheless degenerate if men do not each year rigorously separate by hand the largest specimens."

* * *

The unprecedented growth of manufacturing of all sorts during the past eighteen months has been accompanied by an equally great increase in metal production throughout the United States, which in turn has been attended with a corresponding increase in the use of electricity for operations incident to the mining, milling and smelting of ores from which these metals are obtained, according to editorial comment in The Electric Journal. It may be added, nevertheless, that this increase in cost of copper is today putting off the much needed electrification of Western railways in the high Sierras and Rockies.

shown at a glance to be the individual drive electricity affords as opposed to the composite drive necessitated under the old method. Under this arrangement the vanner and table floors are enabled to have independent operation from that of the jigs, rolls, etc., so that a temporary interruption of the one in no way effects the continuity of operation of the other.

The tell-tale or safety devices are also a feature worthy of note among the desirable characteristics of the electrically operated mill. Many a rope drive has come to an early end in its operating career due to a non-observance of the old adage that "a stitch in time saves nine." In this mill, however, an electrical trip completely shuts down the rope drive when a thread has become disjointed and its unravelling with the consequent danger to the drive as a whole is threatened.

Not only is safety to apparatus thus realized by electrical operation but danger to life is also lessened. An instance of this is seen in the remote control that has been instituted for shutting down the mill at various places, so that the operator has nearly control in case of emergency no matter where his duties may necessitate his presence in the mill. In case of accident on the jig floor, for instance, to operator or machinery, the workman can stop the mill by throwing one of these knife switches and it is impossible to start up again until the knife switch is again adjusted.

One of the most unique features of electrical operation is, however, to be found in the rock house. A large electric magnet is here installed over the spillway on the conveyor belt carrying the ore to the crushers in order to arrest the further conveyance of any iron or steel material that may have gotten into the ore line. The extreme usefulness of such a magnet is forcefully brought out upon examination of the varied collection that the electric magnet draws out from time to time. Drills, drill bits, hammers, track spikes, monkey wrenches, car trips, nails, spectacles and the eternal tobacco can are among the curiosity exhibits taken out by the tractive force of the magnet.

In the operation of the mine, the electric hoist plays a remarkable role of efficiency. In this mine is to be found the first successfully operated large induction motor hoist in the Coeur d'Alene district. The acceleration of the hoist is automatic instead of manual. The engineer opens his controller wide at one stroke and the automatic features of the switchboard control the amount of current taken and the time of acceleration. The charts drawn on the board will also record any accident, unusual condition of motor, track, weight of ore or careless handling by engineers.

Perhaps the most remarkable electrical feature of the mine is that of the electric drive for the pumps and their successful operation. Although the pumps are located ten thousand feet from the portal of the mine, they nevertheless operate at an exceptional standard of efficiency. In fact some years back the motors became submerged in water for three weeks under two hundred foot head and yet without removing the motor from the pumps or taking out the rotor or armature the fourth day after the dewatering they were again in successful operation.

Such typical performances as these make the electric drive for both milling and mining operation indispensable in modern practice.

A brilliant future seems in store for the newly-approved Pacific Coast Section of the National Electric Light Association. After months of effort on the part of Western central station men under the leadership of R. H. Ballard of Los Angeles the power companies of California, Nevada, Arizona and New Mexico have been granted authority to proceed with the organization and early in January a meeting of the executives at Los Angeles will consummate the project.

In no sense does this represent another organization in a field already overcrowded with associations. It merely means the more effective operation of one to which most of the central station men already belong. No additional expense is involved, as a due allotment from the national funds will probably suffice for carrying on local activities after it is once under way.

The first effect should be to strengthen the national organization and stimulate sympathetic interest of Western men in its activities. With the feeling that they may enjoy all the benefits of national affiliation together with all the advantages of local organization should come a greatly increased membership.

The new section will afford opportunity for adequate discussion and presentation of peculiar local problems. Line construction in sparsely settled districts, encouragement of hydroelectric development on the public lands, rates for electric cooking and water heating, the growth of electrochemical industries,—are a few of the questions upon which great light will be thrown.

Nor will the central station men be the only benefactors. The local conventions of the section will facilitate the attendance not only of power company engineers and commercial men but also of the representatives of the manufacturers and jobbers. Such questions as increased discounts on apparatus and appliances sold in the widely scattered communities of the West, better prices on ranges and closer cooperation among all branches of the electrical industry will undoubtedly be worked out to the satisfaction of all concerned.

The purposes to be accomplished by the association are well stated in the tentative constitution as follows:

The object of this association shall be to foster and promote the common interests of its members and to advance scientific and practical knowledge in all matters relating to electric light and power companies; also to establish cordial and beneficial relations with the public and kindred associations, and between manufacturers of electrical machinery and appliances and the members of the association.

The new section will be a substation in a great system for the transmission of experience. It will be a new center for the distribution of knowledge and in turn will feed vigorous thought back into the main system. Thus will sectionalization strengthen centralization.

Pacific Coast N. E. L. A. Section

PERSONALS

E. J. Wallis and F. H. Leggett, of the Western Electric Company, recently returned from a short business trip to Los Angeles.

H. L. Jackman, manager of the Western States Gas & Electric Company at Eureka, has returned from a trip to San Francisco.

Emory Wishon, assistant to the general manager of the San Joaquin Light & Power Company, spent a few days at San Francisco this week.

F. D. Fagan, manager of the Pacific Coast Division of the Edison Lamp Works, recently left for Los Angeles, where he will spend the holidays.

Wm. A. Burr, sales manager of the Nevada Engineering & Supply Company of Reno, Nevada, spent a few days during the week at San Francisco.

A. C. YOUNGHOLM, secretary and manager of the Electric Railway & Mfrs. Supply Company, at San Francisco, has left for a two weeks' trip East.

Geo. B. Sanford, manager of the Great Western Power Company, recently returned to San Francisco from a short business trip to Los Angeles.

B. J. Jakobsen, designing engineer with F. G. Baum, who has been absent from the United States on work in Peru, has returned to the office in San Francisco.

S. A. Taylor, president of the Electric Railway & Manufacturers' Supply Company, recently returned to San Francisco from an extended trip throughout the East.

C. Bassoe, electrical engineer and manufacturer of Norway, is a recent visitor at San Francisco, where he has purchased considerable machinery to be shipped to his country.

H. H. Cudmore, manager of the Mazda bureau of the General Electric Company of New York, recently arrived from Los Angeles and expects to spend a few weeks at San Francisco.

E. C. La Rue has been temporarily assigned to the Portland, Oregon, office of the U. S. Geological Survey, in order to classify water power lands in the Oregon-California land grant.

C. E. Condit, formerly assistant engineer with the Northwestern Electric Company at Portland, has recently accepted a position with the Arizona Power Company at Prescott, Arizona.

Wynn Meredith, of the firm of Sanderson & Porter, recently returned to San Francisco from a five months' stay in Oklahoma, where he was inspecting the company's work, which is being completed on a big pipe line.

Frederick Laist, formerly chief chemist for the Washoe Smelter Works at Anaconda, Montana, has been promoted to the position of general manager. Mr. Laist has recently evolved new electro-chemical processes of ore reduction for his company.

R. H. Ballard, of the Southern California Edison Company, in company with H. H. Trowbridge, attorney for that company, were recent visitors at San Francisco in connection with the consolidation of the Pacific Light & Power Company with their company, which was brought up before the Railroad Commission during the week.

John Frederick Farquhar, commercial department, Washington Water Power Company, Spokane, Wash.; Jiro Komiya, electrical engineer, Imperial Government Railways of Japan, Tokyo, Japan; Harvey L. Lionberger, construction foreman and engineer, Spokane, Wash., and Archibald Johnson Robertson, superintendent of Eastern Division Mt. Whitney Power & Electric Company, Visalia, Cal., have been elected associate members of the American Institute of Electrical Engineers.

J. W. Beckman, associated for a number of years past as electrical engineer with the Great Western Power Company, and formerly with the Aluminum Company of America and the American Cyanamid Company and the research laboratories of the General Electric Company, and H. E. Linden, hydroelectric engineer formerly associated with the Southern Sierras Power Company, Stone & Webster Engineering Corporation and the Sprague Electric Company, have opened engineering offices in the Balboa Building, San Francisco as the Beckman & Linden Engineering Corporation. They will specialize on expert investigation of the electrochemical possibilities adjacent to present and proposed power developments, including every stage in the design and construction of both chemical and power plants. They are also associated with the Chemical Development Company which has a well equipped laboratory for research work in electrochemical fields. Mr. Beckman was largely responsible for the establishment of the caustic soda and bleach electrolytic plant of the Great Western Electrochemical Company at Pittsburg, California, and has also had wide European experience.

MEETING NOTICES.

Wass-hael!

The electrical and machinery men of San Francisco have been bidden to observe this ancient festival and make merry on Saturday afternoon, December 23d, at Bergez-Franks restaurant. The invitation is signed by R. F. Behan as toastmaster and twenty-two others. The price is \$2.50. An elaborate program of entertainment has been mapped out.

Kilo Watt Club Gives Christmas Doings at Key Route Inn.

Wednesday noon, December 20, the Oakland Kilo Watt Club held its second Christmas feed and Christmas tree. The electrical salesmen of the power company of the Oakland division, had for their guests, on this occasion, Mr. Wallace Briggs, general agent; Mr. E. W. Beardsley, general superintendent; Chas. E. Mynard, assistant treasurer, and other prominent electrical men. A general good time was enjoyed by all.

Los Angeles Jovian Electric League.

At the meeting of the Los Angeles Jovian Electric League on December 6th the speaker of the day was Edward F. Trefz. Mr. Trefz was formerly field secretary of the United States Chamber of Commerce and is now associated secretary of Los Angeles Chamber of Commerce. His subject—in keeping with the spirit of the occasion—was "The United States Chamber of Commerce." G. B. McLean, sales manager of the Pacific Light & Power Corporation, was chairman of the day.

San Francisco Electrical Development and Jovian League.

"A day in camp" was exemplified by the Boy Scouts at the December 13th League luncheon, one of the most interesting of the novel series which has been recently put on by the entertainment committee of which N. J. Prendergast is chairman. President L. H. Newbert introduced S. B. Gregory of the Arrow Electric Company as chairman of the day. The first of the speakers was W. S. Woolner, assistant engineer of the Northwestern Pacific Railway who recounted the good work being accomplished by the Boy Scouts on making better citizens. He was followed by H. D. Cross, national field commissioner for the Boy Scouts of America, who explained that the purpose of the organization was not militaristic, but to train boys to meet any emergency. He told of the good work being accomplished in teaching 200,000 boys. Meanwhile a squad of the boys went through many of the evolutions of a typical day in camp. The last speaker was Mrs. S. M. Richardson, chairman of the legislative committee of the Woman's Congress, who spoke earnestly against militarizing the public schools. She urged that the boys be taught the principles of

arbitration and moral and physical betterment. She believes that any attempt at military education should be standardized by the United States and not left to the action of the several states. She gave a strong plea for internationalism and world peace. At the conclusion of this interesting meeting a rising vote of thanks was given the boy scouts and the several speakers.

EXAMINATION FOR ELECTRICAL DRAFTSMAN.

The United States Civil Service Commission announces an open competitive examination for electrical draftsman, for men only. From the register of eligibles resulting from this examination certification will be made to fill several vacancies in this position in the Navy Department, Washington, D. C., at salaries ranging from \$3.52 to \$6 per diem, and vacancies as they may occur in positions requiring similar qualifications in the department at Washington or at any navy yard or other naval establishment of the United States, unless it is found to be in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

TRADE NOTES.

The port of Portland has awarded a contract to the Kilbourne & Clark Mfg. Co., of Seattle, to install two seats of wireless equipment on port tugs, to cost \$3250.

The Hurley Machine Company announces the purchase of 100,000 square feet of land located at Taylor street and Campbell avenue, Chicago. Ground will be broken immediately for a factory with a capacity of 1000 Thor machines daily.

The Terry Steam Turbine Company of Hartford, Connecticut announces the appointment of Stephenson & Nichols, Monadnock Building, San Francisco, as their representatives in Northern and Central California and the Northern part of Nevada.

USE OF ELECTRICITY IN TESTING BREAD AT POMEROY.

According to the Pacific Power & Light Company's Bulletin, of Portland, Oregon, R. H. Kribs, superintendent of the Houser mill at Pomeroy, has been testing each day's run of flour for some time past by baking bread, and has devised a way of carrying on this baking so as not to interfere with his regular duties, and still be able to get fine results.

He has remodeled an electric incubator, using the heating coils and thermostat so that an even temperature is maintained at all times, while the raising process is being carried on. A No. 2 Copeman large oven is used for the baking proper.

Three loaves of bread are baked at one time, and the preparation is as follows: To one and one-half pints of water is added three-quarters of a cake of Fleischman's yeast, and when thoroughly mixed flour is added until a stiff dough is formed. This is placed in the raising compartment for about seven hours at a temperature of from 80 to 86 deg. F., after which it is taken out and one-half pint of water, three teaspoons of salt, two teaspoons of sugar and one tablespoon of lard are added and thoroughly mixed, after which flour, which had also been placed in the raising compartment and is warm, is added until all is stiff. This is replaced in the raising compartment for one and a half hours, and then worked down to be raised again for one hour.

Loaves are then formed, replaced for raising one hour, after which they are placed in the oven to bake.

While the loaves have been raising the oven has been warmed to five of the Copeman indicator and the loaves are placed in the oven at that temperature. The oven is then set to point six, at which it trips out and the oven door is not opened for sixty-five minutes, at which time the bread is

ready to come out. It is golden brown on the outside, both top and bottom, and exceptionally white and smooth inside, being thoroughly done.

The electric bread raiser and electric oven make it possible to obtain absolutely the same results each time, and the daily testing of the flour has enabled Mr. Kribs to detect and rectify any little fault in the process of milling before a quantity of inferior flour is placed on the market, and as a result "Pomeroy Flour" has proven to be of the highest standard and an increased demand has resulted, which is taxing the mill to full capacity.

The time element of every oven varies slightly, but when once obtained can be duplicated indefinitely. DO IT ELECTRICALLY.

RESULTS OF METER TESTING.

In line with its policy of giving first-class electrical service, the Pacific Power and Light Company is spending a great deal of time and money in keeping its meters tested and repaired up to date.

During the first nine months of the year 1916 almost 5500 meters have been tested, which includes approximately one-fifth of the meters at Pasco, all the meters at Sunnyside and Prosser, 1300 meters at North Yakima, one-fifth of the meters at Toppenish, almost 1000 meters at Walla Walla, 358 meters at Dayton, 54 meters at Pomeroy, and five meters at White Salmon, totaling 4305 meters in Washington. The Oregon list includes 400 meters in Pendleton, 172 meters at The Dalles, 297 meters at Hood River, and 308 meters at Astoria and Seaside.

Mr. Junkin is now at Toppenish, and will remain there until he tests all of the meters at that place. He will then proceed to Pasco and complete the testing there.

Mr. Rutherford is now at Pendleton and will stay there until all the meters have been tested. He will then return to Walla Walla and attend to work at that office.

Arrangements have been made to test all the meters at White Salmon and Seaside this winter. Testing work at Hood River and The Dalles is carried on by the local force all the time and is up to date. The same is true at Pomeroy.

BOOK REVIEW.

Alternating Currents. By Carl Edward Magnusson, M.S., Ph. D., E.E. Size: 6 in. by 9 in.; 520 pp.; 475 illustrations; cloth binding. Published by McGraw-Hill Book Company, Inc., of New York City, and for sale at the Technical Book Shop, San Francisco. Price \$4.00.

This book is an outline of lectures and class-room discussions in alternating-current phenomena given by the author during the past ten years to students in the University of Washington at Seattle where the author is professor of electrical engineering.

As explained in the preface to the book, its purpose is to aid the student in gaining clear concepts of what actually takes place in alternating current machinery, to explain the relations between the factors involved and to express the physical facts in mathematical forms in such manner that the student shall understand the equations and be able to use them rationally in the solution of every-day industrial problems.

A few typical problems are well chosen to illustrate the text and these problems add greatly to the value of the work.

Throughout the work the author has unconsciously interwoven many fine points that are applicable to Pacific Coast conditions which are not to be found in other text books of this nature.

The treatment of phenomena connected with transmission lines is especially complete. The book should especially find a wide application among electrical engineers and technical colleges of the West.



NEWS NOTES



INCORPORATIONS.

GALLUP, N. M.—The Citizens Light, Power & Telephone Company is to be incorporated here with capital stock of \$150,000. It is stated that the company is an affiliation of Gallup Telephone Company and the Gallup Electric Light Company and the company is to be affiliated with the Peoples Light & Power Company.

FINANCIAL.

HALF MOON BAY, CAL.—The Half Moon Bay Light & Power Company has been sold to the Western Power Company.

SAN FRANCISCO, CAL.—It is announced that the recent \$1 assessment levied on the stock of the Northern California Power Company has been paid within the time allotted.

LOS ANGELES, CAL.—The public service commission has approved the \$500 bond presented by the city of Pasadena to insure faithful performance of their contract to furnish electric current to the city.

SAN FRANCISCO, CAL.—The Mercantile Trust Company announces that bonds Nos. 39 to 43 and 57 to 160, inclusive, of Midway Gas Company first and refunding mortgage 6 per cent bonds will be redeemed for face value and accrued interest on January 15, 1917.

SAN FRANCISCO, CAL.—The Girard Trust Company of Philadelphia, as trustee of the Western States Gas & Electric Company, is calling for tenders for sale and delivery as of January 22 of the company's first and refunding mortgage 5 per cent gold bonds, due June, 1941, at a price not exceeding par, accrued interest and 5 per cent premium, to the extent of \$48,927.81, the sum now available in the sinking fund. Tenders must state numbers of bonds offered and be addressed to Girard Trust Company, trustee, sinking fund, Western States Gas & Electric Company before January 8, 1917.

SAN FRANCISCO, CAL.—Offerings of the new \$80,000,000 American Telephone & Telegraph Company 30 year 5 per cent collateral trust bonds is being made at a price of 98 and interest to yield approximately 5.15 per cent. These bonds are to be secured by pledge of stock of the New England Telephone & Telegraph Company, the New York Telephone Company, Southern Bell Telephone & Telegraph Company, Southwestern Bell Telephone Company, and Pacific Telephone & Telegraph Company, having a value of 133 1/3 per cent of the amount of bonds issued. The company agrees to maintain this margin of 33 1/3 per cent. The bonds are to be subject to redemption on any interest date at 105 and interest and are to have an annual sinking fund of 1 per cent of the maximum of bonds at any time issued.

SAN FRANCISCO, CAL.—A modified plan for the reorganization of the Northern Electric and the adjustment of the indorsements of Eugene de Sabla, E. R. Lilienthal, W. P. Hammond and the Sloss Bros. has been announced by John S. Drum of the reorganization committee, subject to the ratification of the security holders and the approval of the railroad commission. This plan includes:

1. A \$2,000,000 authorized first mortgage bond issue, of which \$1,000,000 will be used immediately for settling the prior claims, and furnishing approximately \$250,000 for betterment, while the remaining \$1,000,000 will be held in the treasury to meet 80 per cent of the cost of future intensive betterments.

2. An income bond issue, to be exchanged par for par for the present underlying bonds, and on a one-sixth basis for the present overlying bonds.

3. A separate agreement with the note indorsers under which they will be relieved of their obligation on the payment of an agreed sum which will probably be less than \$1,000,000.

4. A five year agreement with the banks holding the notes and pledged bonds, under which they will receive 4 per cent for that term for the notes, which will be kept alive.

5. Common stock for the Sloss claims, unsecured notes, open accounts and the remaining five-sixths of the present overlying bonds, to an amount that the railroad commission may approve.

6. A 5 year voting trust, under which the present creditors, who are the virtual owners, will keep control for that time.

ILLUMINATION.

CHICO, CAL.—Bids for the installation of a lighting system in Chico have been called for by the board of trustees.

SACRAMENTO, CAL.—Bids are being received for installing electroliers at front and side entrances to the court house building.

LOS ANGELES, CAL.—Bids will be received by the board of supervisors for installing a street lighting system in Graham Lighting District.

MARTINEZ, CAL.—Manager Don C. Ray will submit a plan for lighting the entire city in accordance with which plan the lighting system will probably be reconstructed.

KLAMATH FALLS, ORE.—A modern street lighting system will be installed by the California-Oregon Power Company in Klamath Falls at a cost of more than \$10,000.

WHITTIER, CAL.—The city trustees have awarded the contract for the ornamental lighting system for Philadelphia street to John L. Wilson, whose bid of \$7390 was the lowest submitted for the job.

BURBANK, CAL.—Work on the new ornamental street lights on San Fernando road, through Burbank, between Providencia and Cypress avenue, will be started soon. Eighty-four electroliers will be installed.

LOS ANGELES, CAL.—An ordinance has been passed calling for ornamental lighting posts and appliances on Cherokee avenue between Sunset boulevard and De Longpre avenue and a portion of Leland way.

SANTA CLARA, CAL.—The committee appointed from the Chamber of Commerce to look into the electrolier question, stated that the entire work of laying wires and erecting standards could be done for about \$2500.

LOS ANGELES, CAL.—The board of public works will receive bids for the installation of the necessary posts and appliances and for furnishing current for lighting Hobart street between Sixteenth street and Washington street.

BLYTHE, CAL.—B. McCready of Searchlight, Nevada, has been here looking up possible business for an electric light plant. It is believed that the city would support such a plant.

LOS ANGELES, CAL.—The city council has ordered cast iron ornamental lighting posts and appliances to be installed and electric current to be furnished for a period of one year for lighting Hobart boulevard between Washington street and Adams street.

PASADENA, CAL.—Owing to the fact that a resolution ordering work on the Mission street lighting system was adopted before the time for protest had expired, the city council has had to start proceedings over again. Both resolution ordering the work and one awarding the contract were rescinded and new resolutions adopted.

SANTA ANA, CAL.—The San Diego Consolidated Gas & Electric Company has applied to the board of supervisors for a franchise for the erection and construction of poles and wires for transmitting electricity along the public streets and highways within certain described territory. It is proposed by the board to grant the franchise and bids will be received.

TRANSMISSION.

WILCOX, ARIZ.—The common council has granted to Neil McMillan a franchise to construct an electric light and power plant in the city of Wilcox.

LOS ANGELES, CAL.—The city council has authorized the board of public works to enter into a contract with the Southern California Edison Company to construct, for \$831.08, a temporary power line 2700 ft. long to connect Bellevue avenue outfall sewer with the company's line near El Segundo.

RIVERSIDE, CAL.—The Southern Sierras Power Company has contracted to build a high tension transmission line from either Niland or El Centro, to Hanlon Heading, according to a statement of the vice-president of the company. This is part of a power system being built to irrigate a half million acres in Imperial Valley. The cost is estimated at \$300,000.

LONG BEACH, CAL.—The job of reconstructing the city fire alarm system will be started immediately by laying underground all its wires and cables. The legislative body has authorized Commissioner Williams to contract, without bids, price not to exceed \$2000, for materials and labor needed for the work.

KLAMATH FALLS, ORE.—In the city election here the people indicated to the city council by a vote of 566 to 122 that they were in favor of granting to the Keno Power Company of this city a 50 year franchise to supply electrical energy in the city. The Keno Power Company is a local concern, organized by the Kerns Bros. of this city. The only other company supplying electrical energy here is the California-Oregon Power Company, a California corporation.

CHICO, CAL.—A plan for a municipal lighting system through the use of his water rights on Deer Creek, which will be submitted to the board of trustees for consideration at a later date, was presented at a meeting of the Chico Business Men's Association by Denny Murphy. The construction of the power plant would cost approximately \$500,000, and 25 miles of transmission line would be required. The total cost of the plant and wiring is estimated to be \$750,000.

CALDWELL, IDAHO.—Governor Alexander and other members of the state land board have gone on record as favoring a plan by which it is proposed that the state shall build a power plant for the use of the Gem district. Attorney Rice and Dow Dunning have asked the board to ask the state to enter into an agreement with the government whereby the state would guarantee bonds to the amount of \$3000 if the government would construct a power plant at Arrowrock, but the governor has insisted that the state build the plant and retain control of it until paid for by the settlers.

TELEPHONE AND TELEGRAPH.

TOMBSTONE, ARIZ.—With the taking over of the New State Telephone Company by the Mt. States Telephone Company, H. J. Evans becomes manager of the southern end of the district. New equipment will replace the old now in use on the lines taken over.

SANTA BARBARA, CAL.—Geo. B. Bush, president of the Santa Barbara Telephone Company, has been here in connection with the affairs of the company. He stated that plans for consolidation are well under way and the work of merging will be pushed as rapidly as possible. The estimated cost of putting the plants together is approximately \$28,000. The plans include many expensive improvements in equipment.

SAN FRANCISCO, CAL.—Employees of the Western Union Telegraph Company will receive about \$70,000 as a Christmas present, as the result of a special meeting of the board of directors in New York. It was decided that all employees receiving less than \$1000 a year shall be given a bonus of 7 per cent of their salary and all employees paid more than \$1000 shall receive a bonus of 6 per cent of their annual income. The awards will be made Christmas day.

TRANSPORTATION.

SANDPOINT, IDAHO.—A contract has been closed by the Northern Idaho & Montana Power Company covering power for the operation of a new box and shingle mill at Dalkena, Wash. This business will be served by the Newport division of the company.

SAN FRANCISCO, CAL.—Preliminary plans have been drawn by James J. Walsh at the request of local steamship operators for an elevated electric road along the waterfront from the Channel to Fort Mason, a distance of 2.8 miles. The estimated cost is \$1,120,000.

GLOBE, ARIZ.—Through the action of the city council the street railway franchise which has been held by the Globe-Miami Traction Company has reverted back to the city. By the terms of the franchise, L. L. Litchfield, president of the company, will receive \$1500, providing the franchise is eventually taken up, to reimburse him for money expended to interest capital in the project.

SACRAMENTO, CAL.—The judgment of the lower court of Sacramento, which issued an injunction restraining the Pacific Gas & Electric Company from building a street car track across K street on Tenth street in Sacramento, has been affirmed by the State Supreme Court. The appeal was taken by the Pacific Gas & Electric Company, which desired a straight track across K street, alleging a cumbersome switching connection hindered traffic at that point.

MARSHFIELD, ORE.—The Oregon Power Company has completed its 11,000 volt line from Marshfield to North Bend, which line was constructed for the purpose of better serving present power customers and to provide additional facilities for a large amount of new business. North Bend will have a community Christmas tree and the merchants are decorating the business district with streamers of electric lights, the illumination for all of which will be supplied by the Oregon Power Company.

IRRIGATION.

SACRAMENTO, CAL.—Bids are being received for furnishing and installing pumping machinery in the pumping station of Carmichael Irrigation District.

PARADISE, CAL.—The board of directors of the Paradise Irrigation District at their monthly meeting received word that the final report from the State Engineer's office will arrive within a few days. Petitions are in circulation asking for the bonding of the district to the amount of \$350,000, and calling for a bond election, which will be held in January, or early in February.

REDDING, CAL.—On account of difficulties between Contractor Willison and the directors of the Anderson-Cottonwood Irrigation District, the former has paid off 200 hands and stopped work on his contracts with the exception of the tunnel and a small piece of work near Redding. Willison says he has completed sufficient work to receive \$62,500 in addition to former payments but the directors refuse to pay him until the work is checked up by the chief engineer, causing him considerable inconvenience. His contracts amount to about \$200,000 and are from 85 to 90 per cent completed. The contractor will return and finish the work.

FRESNO, CAL.—Over 100 men working with teams and scrapers, are being employed in cleaning the irrigation canals of the Fresno Canal & Land Company and the Consolidated Canal Company, preparatory to the opening of the irrigation season. Water will be turned into the canals in the early part of February. No improvements in either of the systems, in the way of extension or the erection of new dams, have been planned for the coming year. The Fresno Canal and Land Company has 346 miles of main canal, and the Consolidated Canal Company, 260 miles. Both are owned by the same interests.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

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| A-1 American Ever-Ready Works of National Carbon Co
Los Angeles; 755 Folsom St., San Francisco; Seattle. | M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco. |
| B-1 Baker-Joslyn Company..... 10
71 New Montgomery St., San Francisco; 911 Western
Ave., Seattle; 353 E. Second St., Los Angeles. | N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco. |
| I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco. | N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San
Francisco. |
| C-1 Century Electric Co..... 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Fran-
cisco; 65 Front St., Portland, Ore. | N-3 National Lamp Works of G. E. Co.....
(All Jobbers.) |
| C-3 Crocker-Wheeler Co..... 2
87 New Montgomery St., San Francisco; 228 Central
Avenue, Los Angeles. | N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco. |
| C-4 Cutler-Hammer Manufacturing Co..... 11
579 Howard St., San Francisco; Morgan Bldg., Portland,
Ore.; San Fernando Bldg., Los Angeles. | N-6 National Carbon Co.....
Cleveland, Ohio. |
| D-4 Davis Slate & Manufacturing Co.....
Chicago, Ill. | O-1 Okonite Co. (The)..... 16
(All Jobbers.) |
| D-2 Dearborn Chemical Company..... 12
355 East Second St., Los Angeles; 301 Front St., San
Francisco. | P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth
St. No., Portland; 200-210 Twelfth St., Oakland; 575
Mission St., San Francisco; 307 First Ave. So., Seattle. |
| E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los
Angeles. | P-4 Pelton Water Wheel Co..... 12
2219 Harrison St., San Francisco. |
| E-2 Edison Storage Battery Co..... 12
206-8-10 First St., (near Howard), San Francisco. | P-5 Pierson, Roeding & Co..... 16
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San
Francisco; Colman Bldg., Seattle. |
| E-3 Electric Agencies Co.....
279-283 Minna St., San Francisco; 419-421 E. Third St.,
Los Angeles. | P-7 Pittsburgh Piping & Equipment Co..... 16
Monadnock Bldg., San Francisco. |
| E-4 Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco. | S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco. |
| E-5 Electric, Railway & Manufacturing Supply Co..... 12
34 Second St., San Francisco. | S-4 Southern Pacific Co..... 2
Flood Bldg., San Francisco. |
| E-6 Electric Novelty Works.....
533 Mission St., San Francisco. | S-5 Sprague Electric Works..... 4
Rialto Bldg., San Francisco; Colman Bldg., Seattle;
Corporation Bldg., Los Angeles; Electric Bldg., Port-
land; Paulsen Bldg., Spokane. |
| E-7 Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago. | S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian
Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815
Newhouse Bldg., Salt Lake City, Utah. |
| F-3 Federal Sign System (Electric).....
618 Mission St., San Francisco. | T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co.,
Pacific Coast Representatives. |
| G-1 General Electric Co..... 13-14-15
724 So. Spring St., Los Angeles; Worcester Bldg., Port-
land; Rialto Bldg., San Francisco; Colman Bldg.,
Seattle; Paulsen Bldg., Spokane. | T-2 Tubular Woven Fabric Company..... 10
Pawtucket, R. I. |
| H-1 Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.) | U-1 United Sheet Metal Works.....
575 Howard St., San Francisco. |
| H-2 Hemingray Glass Co..... 12
236-240 So. Los Angeles St., Los Angeles; 345 Oak St.,
Portland; 807 Mission St., San Francisco. | W-1 Wagner Electric Manufacturing Company..... 3
St. Louis, Mo. |
| H-3 Haller-Cunningham Electric Co..... 12
428 Market St., San Francisco. | W-2 Western Electric Co..... 4
Eighth and Santee Sts., Los Angeles; 1900 Telegraph
Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907
First Ave., Seattle; 45 North Fifth St., Portland, Ore. |
| H-4 Hubbard & Co..... 3
(See Pacific States Elec. Co.) | W-3 Ward-Leonard Electric Co..... 15
Mt. Vernon, New York. |
| H-7 Hurley Machine Co.....
New York and Chicago. (See Pacific States Electric Co.) | W-4 Westinghouse Electric & Manufacturing Co..... 5-6
50-52 East Broadway, Butte; Van Nuys Bldg., Los
Angeles; Couch Bldg., Portland; 212 So. W. Temple,
Salt Lake City; First National Bank Bldg., San Fran-
cisco; Second and Cherry Sts., Seattle; Paulsen Bldg.,
Spokane. |
| I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles. | W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.) |
| I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco. | W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway,
Los Angeles. |
| L-1 Leahy Manufacturing Co..... 12
Eighth and Alameda St., Los Angeles. | |
| L-2 Locke Insulator Manufacturing Co..... 16
(See Pierson, Roeding & Co.) | |
| M-2 McGlaulin Manufacturing Co.....
San Rafael, Cal. | |
| M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland;
Kearns Bldg., Salt Lake City; Sheldon Bldg., San Fran-
cisco; Mutual Life Bldg., Seattle; Santa Rita Hotel
Bldg., Tucson. | |

Allegro



